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Technical Editor: C. O. BRETTELLE, M.I.E.E. *Joint Managing Director:* E. A. GATEHOUSE, M.I.E.E., A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

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Electrical Materials.

ALTHOUGH the year 1929 ended with the price of electrolytic copper higher than it was at the close of 1928, it can hardly be said that the market outlook is as favourable as it was twelve months ago. One reason for this is that the American stocks of refined copper, which totalled about 65,500 short tons on December 31st, 1928, had increased to very nearly 127,000 short tons by the end of November, 1929 (the latest data available at the time of writing), whilst another reason is the uncertain outlook with regard to the rate of consumption. The early months of the year just closed saw a very heavy absorption of the metal by users in the United States, the average domestic deliveries during January, February, and March, being over 101,000 short tons a month, whereas during the three months of September, October, and November, the average monthly domestic deliveries were barely 91,000 tons. In the early spring, a very active demand developed from American consumers, which resulted in a firm market and stimulated European consumers to purchase freely also, in order to make sure of their supplies. Producers met this demand by steadily raising their prices, so that values were driven upwards until late in March the price of electrolytic copper was about £112. That proved to be the peak, buying began to slacken, and in the course of a few weeks, electrolytic copper came down to about £84. Since then the market has been less sensational, prices having been more or less stabilised. It is understood that the leading producers are putting into effect a curtailment of output in order to restore equilibrium between production and consumption, and so far they have been maintaining their prices, in spite of a very slack demand, and of price-shading by other sellers. A drop in the price asked by the Incorporated Exporters seems to be due, however.

The year 1929 was not a very satisfactory one from the point of view of the tin producer, as will be realised when it is remarked that the price of "cash" standard averaged £223 4s. 8d. in the month of February, but

dropped to an average of £179 10s. 2d. in December. Whilst the consumption of the metal was good, particularly in the United States, the production was large, with the result that the "visible supply" expanded. As the increase in output is the result of the good prices which were obtainable during recent years, it is to be inferred that the drop in values will have the reverse effect, and that sooner or later the production will slow down. A feature of interest was the effort of the recently formed Tin Producers' Association to effect, by agreement, a concerted restriction in output. One suggestion is that during 1930 work at Malayan mines should be confined to six instead of seven days a week, and that a complete stoppage should take place for two or three weeks, with a corresponding curtailment by producers in other countries. As efforts have been persistent to bring about some co-operative action of that kind, this has not been without effect on market sentiment.

Although not altogether a satisfactory one, 1929 may prove to have been an important year in the lead industry, because of the formation last August of the Lead Producers' Association. This organisation covers the output of Mexico, Canada, Australia, and Burma, and was originally brought into being owing to the low prices ruling for lead. Since its inception, however, consumption generally has been hardly capable of absorbing the available supplies, and prices have declined somewhat. With the exception of a record jump in prices of over £5 per ton one day in March, due to concentrated Continental and American speculative buying, values did not fluctuate very widely, the market having had a rather subdued appearance throughout the year. In this country consumption was moderately good, but on the Continent depressing conditions prevailed in recent months. Production ruled rather above that of 1928, but the American output is now undergoing some curtailment. Nevertheless, with the big Mount Isa property expected to reach the producing stage in 1930, the outlook seems none too rosy, unless consumption shows an unexpected improvement during the coming year.

The year has proved one of considerable difficulty for the rubber industry. With the removal of the Stevenson restriction scheme at the end of October, 1928, there was a flood of exports from Malaya, where supplies had been accumulating for six months or more, the liquidation of these stocks continuing well into 1929. In addition, the unrestricted Malayan output proved larger than was anticipated. These adverse conditions were mitigated in the early part of the year by unparalleled activity in the motor car and tire trades, in the United States and Europe, entailing a record consumption of rubber. Nevertheless, supplies were more than sufficient to meet this demand, and when from May onwards American consumption began to fall off, followed later in the year by quieter conditions in Europe, stocks began to increase rapidly. The first three or four months of the year saw the surplus supplies going mainly to America, but subsequently England became the chief storing centre, and stocks here showed an average increase during 1929 of about 1,000 tons a week. Prices moved more or less in accordance with the volume of demand, upwards of 1s. 1d. per lb. being paid for spot in March, when the American demand was at its peak, while as low as 7¾d. was accepted towards the end of the year. During 1929, Dutch producers attempted, without much success, to formulate a scheme for the control of output and prices, and a committee of the Rubber Growers' Association rejected the idea of a central selling organisation as impracticable, owing to the impossibility of securing native co-operation. Consumers are thought to be but poorly covered, and with the adverse factors apparently discounted in current prices, it is hoped that improved buying will be seen in the early months of 1930, accompanied by rather higher prices.

The fluctuations in the prices of copper, lead, and rubber during the past year are illustrated by curves on p. 56 of this issue.

The Hope Cement Works.

THE new cement works at Hope, Derbyshire, of Messrs. G. & T. Earle, Ltd., a description of which is concluded in this issue, are of particular interest to electrical engineers from many points of view. In the first place, they afford an excellent example of a large, modern all-electric factory, presenting several novel and, in some cases, unique features in connection with the application of the electric drive to heavy machinery. The successful automatic control of the compressor plant for the secondary rock drilling is a creditable achievement, and so is the record made by the electric navvy, for which credit is largely due to the "Eddystat" control for the larger motors. The third-rail system on the hill top; the drives for the very heavy crushing machinery; and the excellent examples of remote and variable-speed control, particularly in the cases of the scraper digger equipment in the clay field, the huge calcining kilns and the raw and cement grinding mills, are among the many other features which help to make a visit of an electrical man to the works a profitable one.

An average loading over a 24-hour day and a 7-day week of 3,000 kW is another point of importance of the works to the electrical industry, and a load factor of 60 per cent. for such an installation is of great value to the supply engineer. While, of course, the very nature of the continuous-running processes of the works lends towards the attainment of high load factor, credit should be given for the close co-operation between the electrical and manufacturing sides of the works which has led to the judicious planning of the running of the plant in order to obtain as high a load factor as possible.

The Commissioners' Report.

THE ninth annual report of the Electricity Commissioners appears about nine months after its predecessor—another indication of the speeding up of their statistical work, to which we referred in these columns on December 13th, when reviewing the latest issue of Engineering and Financial Statistics. The criticisms which we made in that case have general application in the present instance.

On another page we begin a summary of the annual report and need do no more here than refer to what the Commissioners regard as the principal feature of the past year, *viz.*, the great progress made in the preparation and carrying out of the new regional schemes for adoption by the Central Electricity Board. The schemes adopted now cover 43 per cent. of the total area and 75 per cent. of the total population, consuming 80 per cent. of the total output.

United States Activities.

WHETHER in finance, commerce, or world politics, what America does is followed with the greatest interest or concern. The United State claims, with justice, to be the most highly developed country, in an electrical sense, in the world. That development has passed beyond her borders and she has assumed a leading position in the world electrical trade. Therefore any information regarding the country's electrical manufacturing industry and trade is of interest to British manufacturers and exporters. Elsewhere in this issue we deal with certain aspects of American industry.

The first section of the article deals in a general way with the prospects of the American electrical manufacturer. From this it would appear that recent financial events are expected to affect the industry, although the anticipated decline is described as "a return to normal activity."

The latter part deals with a subject of increasing importance: the setting up of branch factories in foreign markets. This has often been done by British manufacturers in the past, and for similar reasons, but it is opportune to have the case re-stated. Special interest attaches to the American writer's view of possibilities in the British Empire.

Electricity in the Manufacture of Cement.

Some impressions of a visit to the new cement works at Hope, Derbyshire, of Messrs. G. & T. Earle, Ltd.

(*Concluded from page* 10.)

From the cone crusher the stone falls on to a 24-in. belt conveyor, 68 ft. long, driven by a 5-h.p. motor through reduction gear, fig. 20. From this belt the stone is emptied on to another 24-in. belt conveyor which transports it for a further 502 ft. In this case the driving motor is of 35 h.p., and is controlled by Ellison switchgear. From the last-mentioned belt the stone falls into a limestone silo which has a capacity of 2,000 tons, and from this it is fed into the raw grinding mills, at which stage it is met by the treated clay from the clay field. Fig. 12 shows the Ellison switchboard for the pumps and diggers in the clay field.

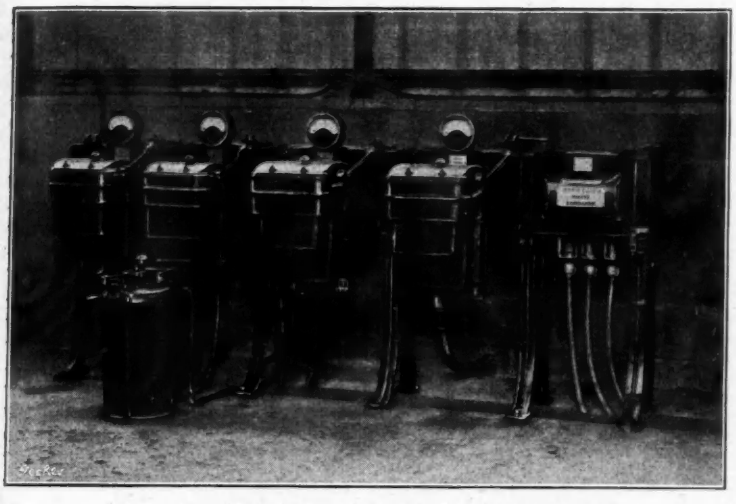


Fig. 12.—Switchgear for Clay Field Equipment.

The plant in the clay field consists of Sauerman scraper - digger equipment, the winch and rope system of which can be likened to a main and tail haulage. The whole equipment is driven by a 150 - h.p. slip - ring motor, 400 V. The driving equipment for the scraper - digger equipment is shown in fig. 16. The speed of the motor is varied by means of a water-cooled liquid controller. Remote rotor control is arranged for this motor from an observation tower by means of a straight through lever, wire rope, and sheaves, the rope passing through a horizontal distance of 32 ft. From the observation tower the operator controls the digging of the clay and its passage into the wash mill. Reversing of the winch is effected by means of clutch-operated motors fitted to the winch; these motors are, of course, also controlled from the observation tower. The digger feeds the clay into a 20-ft. diameter wash mill which is belt-driven by a 104-h.p., 750 r.p.m., 400-V motor. The clay is washed and mixed with water (60 per cent.) into a clay slip from which the mixture is pumped into clay-slip tanks by a three-throw 12-in. ram pump driven through reduction gear by a 35-h.p., 750-r.p.m., 400-V, slip-ring motor. To prevent the clay from settling in these tanks compressed air is used to agitate the mixture, the compressed air being obtained from plant in " sub " B building, fig. 14, consisting of a battery of five rotary compressors, each directly driven by an 80-h.p. 735 r.p.m. slip-ring motor, and two rotary vacuum pumps, each driven by a 25-h.p. 960-r.p.m. slip-ring motor. On leaving the clay tanks the mixture falls by gravity into a clay - slip measurer, the inflow control being effected by means of an automatic ½-h.p. motor-operated 6-in. float

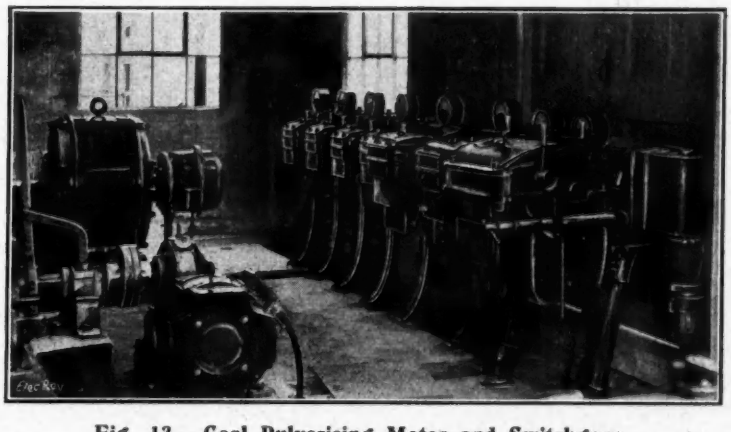


Fig. 13.—Coal Pulverising Motor and Switchgear.

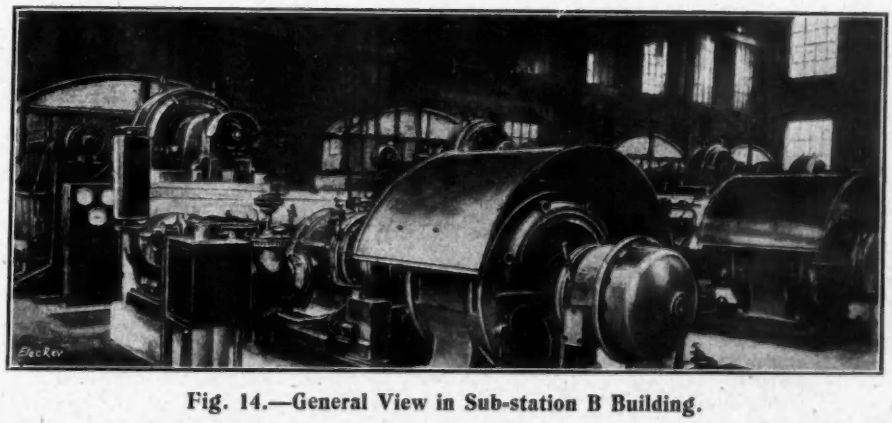


Fig. 14.—General View in Sub-station B Building.

valve, fig. 19. The clay slip is then measured by spoon feeders dipping into the clay tank and emptying definite quantities into the raw grinding mills. The spoon feeders are driven by a "Lindsay" variable-speed gear which, in turn, is driven through reduction gear by a 5 h.p. motor.

The clay now meets the limestone in the raw grinding mills, and the mixture is ground into a fine slurry with a water content of 37 per cent. The raw grinding mills are driven by 650-h.p. auto-synchronous motors, 3,000 V, 750 r.p.m. These motors have a leading power factor of 85 per cent., and they are governed in each case by a liquid controller and short-circuiting contactor supplied by Messrs. Allan West & Co., Ltd. The motors were manufactured by Messrs. Crompton Parkinson, Ltd. They drive through reduction gears the raw grinding mills at 19 r.p.m. The starting torque of these mills is very heavy indeed, but no difficulty whatever has been experienced. Interlocking for the mills is carried from the no-volt coils of the Reyrolle switch-gear to the liquid controllers, then to the high-speed shafts of the reduction gear, again through the second-motion shafts, and finally to the low-speed shafts. They are so fitted that should a movement of the shaft take place in any direction the circuit would be tripped.

From the raw grinding mills the slurry flows into a pump pit, from which it is pumped into five slurry tanks by two pumps, each driven by a 50-h.p., 415 r.p.m., 400-V, directly-coupled motor. As

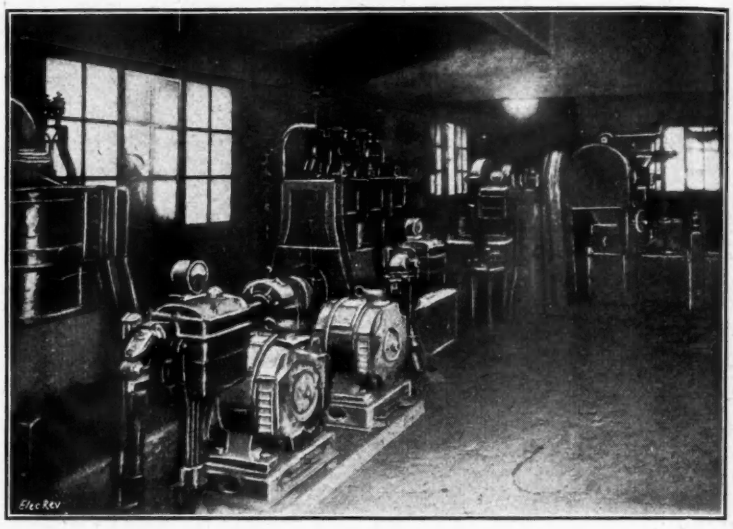


Fig. 15.—Electrical Equipment for Packing Machines.

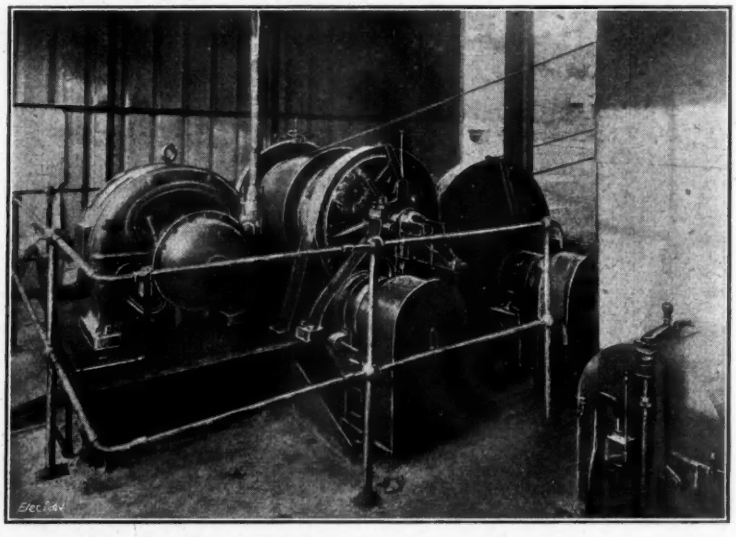


Fig. 16.—Driving Equipment for Scraper-digger Gear.

in the case of the clay-slip tanks, compressed-air is supplied to the slurry tanks to prevent settling. The mixture is allowed to flow into a further tank for measuring purposes, the flow being measured in a similar manner to that in the case of the clay-slip. The next operation takes the slurry into a kiln in which it is calcined into clinker. There are two kilns of the rotary type, each of which is 269 ft. long by 8 ft. 4 in. in diameter, increased to 10 ft. 4 in. in the firing zone and weighs 500 tons. Each kiln is driven through reduction gear by a three-speed squirrel-cage motor. The respective h.p. capacities and speeds are 85, 70, and 35 h.p. and 730, 580, and 365 r.p.m. The final speeds on the kiln are 1, ½, and ¼ r.p.m. The main control for the kiln motors is by Brookhirst auto-transformer starters.

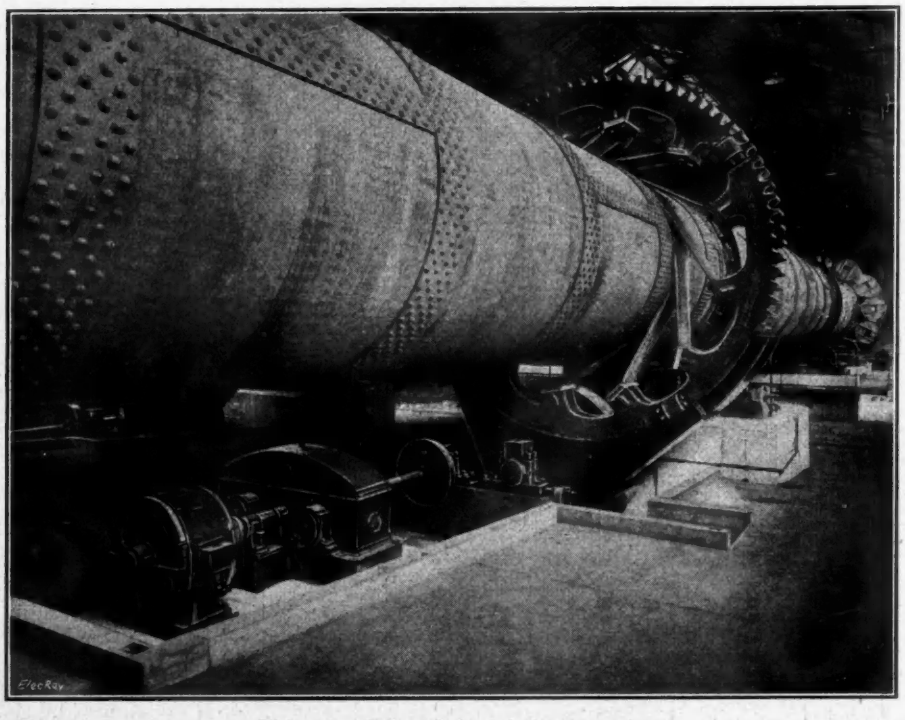


Fig. 17.—Kiln-driving Arrangements.

At the coal end of each kiln a large Keith and Blackman exhaust fan draws the hot gases through the kiln. Each fan has a "Texrope" drive from a 3-speed motor identical with those driving the kilns. Fig. 17 shows the driving arrangements for one of the kilns. At the end of each kiln a

cooler is fitted as an integral part of the equipment. Dust-collecting gear is also fitted to each kiln, and is driven by small motors. On leaving the kiln the clinker is belt conveyed to a clinker storage pit where it is seasoned for a period of several hours.

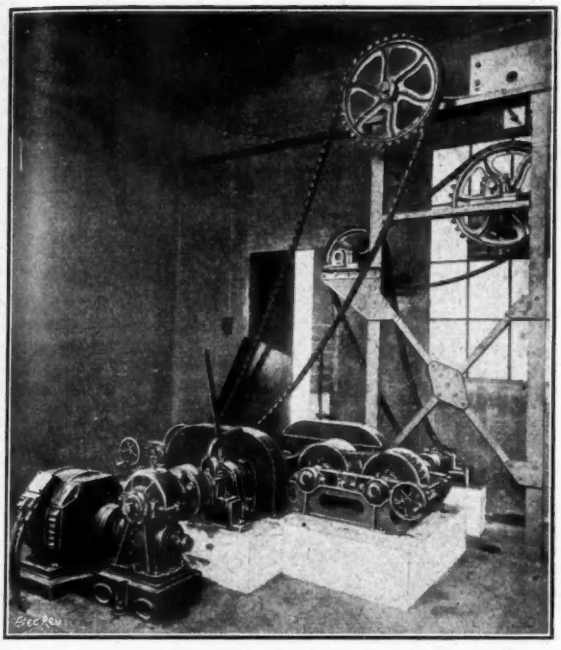


Fig. 18.—Special Reduction Gear for Coal Conveyor.

Pulverised coal is used for the "burning" process in the kilns. Raw coal is received by rail direct into the works; it is first dealt with by a Mitchell wagon tippler driven by a 15-h.p. motor by the British Thomson-Houston Co., Ltd., through reduction gear, and is then taken to a raw-coal silo by means of an elevator driven by a 25-h.p. motor through special reduction gear, fig. 18, and from the silo it is fed into two air-swept pulverising mills by means of two conveyors driven by 5-h.p. motors. The mills are driven by 150-h.p. motors, 400 V, 725 r.p.m., controlled by Ellison circuit breakers and M.V. liquid starters. Fig. 13 depicts some of the coal mill motor equipment. From the pulverising mills the fuel is elevated by a 5-h.p. motor

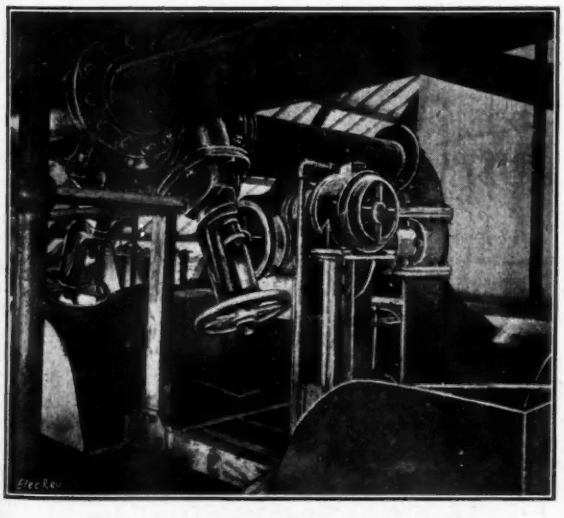


Fig. 19.—Electrically-operated Valve.

to hoppers, from which it is fed into the kiln by high-speed Keith and Blackman fans driven by 35-h.p., 1,450-r.p.m., 400-V motors.

After the clinker is seasoned it is taken by means of an overhead crane into a storage hopper, from which it is fed to two feeding tables where it is weighed out before serving the cement grinding mills. The crane is equipped with three motors by the English Electric Co., Ltd., and has a travelling speed of 300 ft. per min. The grinding mills are driven by 750-h.p., 750-r.p.m., 3,000-V auto-synchronous motors, and the driving arrangements are practically the same as those for the raw grinding mills, except that the actual mill speed is 21 r.p.m. A special feature of the cement grinding mills is an electrically operated filter, fan, and conveyor arrangement for keeping down the dust. The four grinding-mill motors, two raw grinding and two cement grinding, are arranged in a line in the same building which houses sub-station B and the air-compressor plant. Fig. 14 is general view in this room; the four mill motors are shown in the background and the compressor plant is in the foreground.

On leaving the mill the ground cement falls into a screw extraction conveyor, which places the cement over two chutes fitted with containers. As soon as one container is full it is automatically closed and the other one is opened. Compressed air is then admitted to the full container, and the cement is forced through pipes over a distance of 100 yards into one of six finished cement storage silos. On leaving the silos the cement is placed

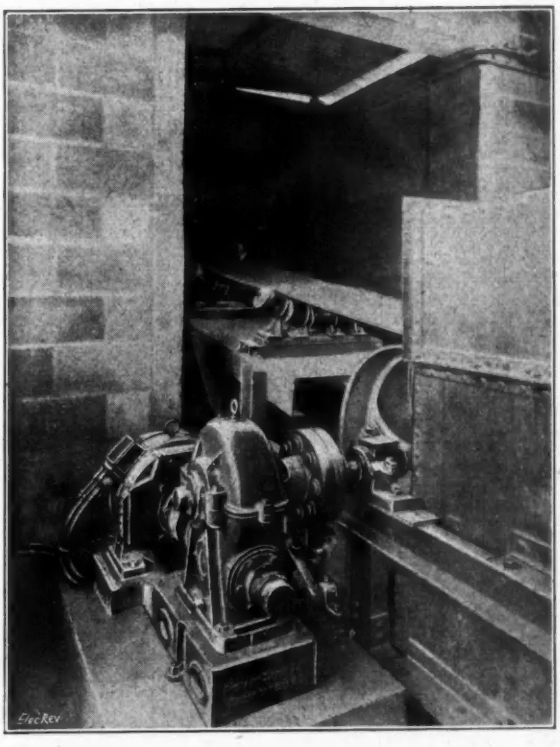


Fig. 20.—Driving Gear for 68-ft. Conveyor.

into a set of containers similar to those described in connection with the cement mill, and from these containers the cement is, by means of compressed air, conveyed to a shipping hopper. Three transporter systems for conveying the cement are each driven by a 2-h.p. motor. For transporting the finished cement from the grinding mills to the silos an 80-h.p. motor is used driving a rotary compressor at a pressure varying from 40 to 60 lb. per sq. in. For transporting the cement from the silo to the shipping hopper for packing two rotary vacuum pumps are used, each driven by a 25-h.p. motor, and two 80-h.p. motor-driven compressors. The whole of the compressor range is so interconnected that any one compressor or more can be employed to carry out the required duties.

From the shipping hopper the cement is conveyed into a small steel hopper in which the cement is mechanically agitated and aerated by compressed air to make the cement liquid, so that it may be run into the sacks. This hopper and the mechanism on to which the sacks are placed form a packing machine on which empty

sacks are placed and automatically filled with cement. The filled sacks are tripped off the packing machine automatically and conveyed directly into railway trucks for outward transport. Each of the packing machines is driven by a 10-h.p. motor through reduction gear, while small rotary compressors and fans are each driven by a 3-h.p. motor. Fig. 15 depicts the electrical equipment for the packing machines. The sacks are conveyed to the packing machine by a motor-driven belt conveyor through reduction gear.

It is worthy of note that all the 3,000-V switchgear in the works has a rupturing capacity of 100,000 kVA, and that all the low-voltage switchgear installed has a minimum rupturing capacity of 27,500 kVA. In addition to the other equipment mentioned, practically all the motors employed throughout the factory were supplied by Metropolitan-Vickers Electrical Co., Ltd.

In conclusion, we are indebted to Mr. O. Wedgewood, the works manager, for permission to visit the works and to take photographs, to Mr. Hird, electrical engineer to the company, for his assistance in the preparation of the above notes, in which connection also should be mentioned The Yorkshire Electric Power Co., and to Metropolitan-Vickers Electrical Co., Ltd., and Messrs. George Ellison, Ltd., for some of the photographs reproduced.

The Design of Control Rooms.

Suggestions as to the layout of apparatus, based upon principles determined by working experience.

By JOHN DEAN.

THE old-fashioned switchboard, tucked away somewhere in the engine-room, was little more than a special kind of wall. Alterations of layout have been necessary because an impossible length of gallery would be required to contain all the panels in a central station, and because the importance of control work has justified its separation from the rest of the plant. As designers, we can trace the work of two distinct schools through the stations that have been built, or modernised, during the last ten years. Some have designed, scientifically, from first principles—which they have had to find for themselves—others have adopted the simpler method of arranging panels along three walls instead of one, and calling the result a control room. We are still extending, still building, but control rooms are no longer a novelty in this country, and should be no longer a matter for trial and error. We know from experience, now, that certain things are essential to a real control room, if we are to ensure the best use of the apparatus we put into it and the most efficient service from the operators—whatever refinements ingenuity cares to add.

The points to consider are: the walls, ceiling, and floor of the room itself; the instruments and meters that control and measure power flowing to and from the station; the telephone system; and the most efficient arrangement of these three.

The necessity for the operator to see every panel on the main switchboard from the position in which he controls his own generators governs the minimum floor area; the other limit is that of comfortable, and rapid, vision. We have been inclined to allow too much room, and should remember that a miniature dance floor means unnecessary steps and wasted seconds when these are precious. Moreover, operators may spend from six to twelve hours on pure routine work, with a sudden batch of trouble ten minutes before they go off shift, and it pays to have them nearly as fresh, then, as when they came on. To the same end, the room should be kept airy and light, and, if floor space is to be kept down, a volume of "excess air" must be allowed above the usual ceiling level.

Daylight is better than artificial light, while it can be used. Design the distribution of that as carefully as you plan the electrical equipment, and make the ventilators dust-tight when they are closed. Nothing is more irritating than smeary log-sheets and a gritty floor, and there is certain risk of this in a room situated right on the plant. Horizontal sun-blinds may save a couple of fans in summertime and prevent glare; the effect of total reflection from glass meter-fronts is annoying and dangerous.

The walls of the room need little comment; everyone knows that dark colouring wastes light, and a highly-polished surface causes eye-strain. Black and white floor-tiles, arranged chessboard fashion, look well in Press photographs, but are not exactly restful, and may become slippery. True, an expert, by skidding from Tunbridge Wells to Timbuctoo, may save a valuable interconnector, but that sort of thing is to be discouraged in a control room. Polished wood is definitely slippery, so is mosaic, which always looks stained unless it is absolutely spotless and, has a habit of cracking. One of the new Northern stations has put down a rubber composition; cork linoleum is a less expensive substitute, and an old and tried friend. It is wise to be generous and lay a strip of cocoanut matting on the operating side of the control desk, and behind the machine regulators; it is unhealthy—from the station engineer's point of view—to have the men dancing about on an icy floor while lowering speed. Warm the room as a whole, not parts of it by "spot-heating." These details are not merely concessions to the operator's comfort, they are a matter of his output/input ratio. Again, to the station engineer—the customer, as it were—this is important. Flood-light the room from bowl fittings, and little special lighting will be wanted, but, if you must "spot" an ammeter, do not let the lamp-shade hide the needle.

Meters are standardised by the B.E.S.A., but we have a choice of scales, and it is not good enough to specify the range and leave the rest to the manufacturer. He may sub-divide a kilowatt-meter into 250 kW divisions and number in 2,500 kW's, or sub-divide to 500's and number the 5,000 kW points. There is a big difference between these when it comes to rapid summing of loads; the second is the better. B.S.S.89—1926, Clause (h) requires *a distinctive marking of that portion of the scale (if any) which exceeds the rated current or voltage.* It is more important to insist on that, than to require a distinctive colouring of each type of meter. I have visited plants where kilowatts are always green, volts red, and amperes yellow, the colours being painted in a thin band beneath the respective scales. Rarely can any of the staff say off-hand which colours represent which units, for the simple reason that the name KILO-

WATTS in bold lettering stands out far more clearly than the colouring, which is quite unnecessary although it looks awfully sweet. As a matter of fact, if you do decorate the station in this way you are asking for ridicule from the very people whose opinions matter most—fellow engineers who visit your layout to compare it with their own.

Variation of system frequency is normally caused by variation of system load, and—with skilled operators at each station—load distribution can be kept at exactly pre-set proportions by working to frequency, keeping this steady and occasionally checking the actual loading of individual stations. Specify a frequency meter of the pointer type with a large scale, and put it where it can be seen.

Circuit-breaker controls must be neat, and rapid in action. Decide which type of control involves the fewest movements, and the most natural ones, to operate it: rotary type, push-pull, or the flap type, with 180 deg. play between "On" and "Off" positions. Opinions differ, but the first, while simple, is essentially right-handed, the second is too easy to operate by accident, and the third may, at rare times, cause a wasted moment. But the last is neat, natural to operate, and gives time to avoid a mistake—which is worth considering. Use a distinctive control handle for earth and main controls, and label them clearly. Avoid words on the labels that are common to both duties, *e.g.*, "Earth" and "Main" are distinctive and sufficient; "Oil circuit-breaker—Earth Switch" and "Oil circuit-breaker—Main Switch" are chaotic and unnecessary.

Apparently, the dream of every operator is a system diagram that will work itself; I doubt very much whether we shall ever be allowed to fulfil that dream in this country. At any rate, the diagram must be a live one, in the sense that it should show the state of the system from minute to minute, and this can be done simply in several ways, either on a wall or desk diagram. For example, the semaphore arrangement, hand-operated, can be applied. The wall type is, naturally, the clearest on account of its size, but on the whole it is unsatisfactory, because it involves a step-ladder and an auxiliary junior to operate it. An arrangement that forms the centre panel of the control desk, inclined at an angle of about 15 deg. from front to back, should be large enough to show all feeders and sub-stations, switches open or closed, and feeders earthed or out of commission, without taking too much room. Incidentally, give the switches of each station a number, and let them be known by their place-name and number only. "Aston No. 4 switch" is definite, and easily grasped; such a label is infinitely better than "Ashton-Burnley 33 kV, No. 4," or "No. 4 33-kV Burnley switch at Ashton."

The best type of telephone is the combination transmitter and receiver with a plug connection to a socket beneath the front edge of the desk. These are light, can be used standing up, and leave a hand free for the scribbling-pad. Three of these hand sets, plus the G.P.O. and house 'phone, are quite enough for two men to deal with when the system is upside-down, and everybody wants to talk to the power station, including Mr. Jones, who says the lamp has gone out and inquires if anything is the matter. There is supposed to be this advantage about the direct-line system: that the district engineers at important stations—as if they all were not important to their respective district engineers—need not wait for a clear line to the control centre. But consider the fallacy of ten separate instruments—as I have seen—with one man who wants to charge a feeder; a second who wants to close in his end of it to an entirely separate source of supply; a third who asks, with kindly interest, how much load you are doing; the mains chief, who expects to be told exactly what has happened; and six people who are anxious to tell you they have had a surge, but that "nothing has come out." And all these calls coming through at once. Remember that, once sorting-out has commenced, one man at the station will be operating and the other controlling by 'phone, and imagine the difference it makes when messages come in a string—the second one, in the case above, modifying the first instead of confusing it. Careful design of telephone systems now can save minutes of total failure of supply in the future.

The arrangement of the system diagram and telephone switchboard on the desk depends upon their size and shape, and whether the operator will be required to keep to the operating side of the desk, or sit behind it, facing the main board. He invariably did the latter, in the old days, when he spent most of his time compiling an enormous log-sheet, but it is doubtful practice now, as it not only encourages him to sit, elbows on the table, reading the wireless magazines, but forces him to run "round the counter," as it were, every time he wants to operate, and dive back again when the 'phone buzzer calls him (by the way—use a buzzer, not a fire-alarm bell). A simple rule determines the best arrangement: the operator must be able to hear, while standing, what a colleague on the 'phone is telling him about a feeder whose course he can follow on his mains diagram, and whose source of supply he can see on his own switchboard. The desk need not be large, but must have clearance before the diagram and the telephone board, with room for a log-book and pad. The telephone board must be in the centre, to enable two men to operate it at once, when absolutely necessary, and this may mean standing the diagram on a small table, or easle, of its own. Consider that a swing-chair is easier to get out of in a hurry than one that must be pushed back, knocked over, and kicked out of the way.

The desk, main switchboard, and machine controls should be arranged from the point of view that the station's generators are the centre of the system, and will supply the kVA feeding into a fault; group the field and speed-control pillars near the desk. The main switchboard can form an arc, three sides of a square or oblong, or a horseshoe; in each case, generator panels form the central board—facing the corresponding regulating pillars—flanked by transformer-banks, trunks, and feeders. If the generators are coupled with their transformers as a unit, put controls for both on the same panel. Group main transformer-banks, group interconnectors, group feeders. This means an order of control panels different from that of the actual switches in the switch-room or on the "raft," That is necessary, and a not very great disadvantage. The relative directions from which cables and lines enter the station determines the position of the switches, but the duty of the switch determines the position of its panel in the control room. Moreover, six generators would not, actually, be adjacent on the bus-bars, although their panels would have to be grouped, for efficient working.

As I said at the beginning, this is merely a catalogue of elementary principles. The best thing to do is to visit any fair-sized station, stay as long as you decently can, and find out what the men actually have to do. Do not take in all they tell you about designers, but notice the many little points that mark the world of difference between mere assembly and *design*.

Fog Dispersion.

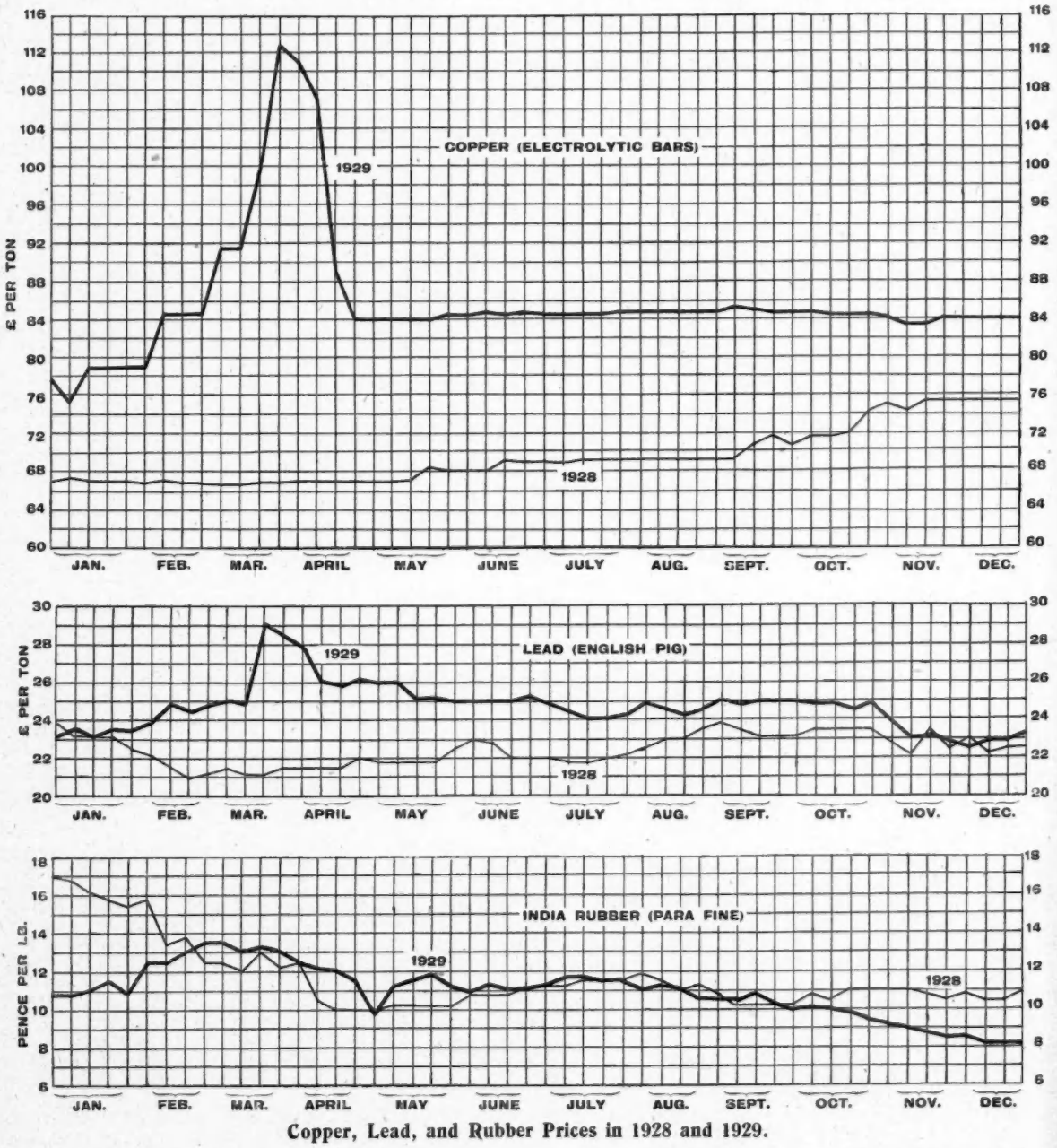
A device intended to disperse fog sufficiently to enable vehicle drivers to see their way for some distance ahead is being developed by Sphinx Electric, Ltd., which has acquired the rights of the method from two London men. The idea was suggested by the fact that when a brazier is lighted during foggy weather an area of clear air surrounds the fire, caused by the drying of the atmosphere. The "Fog-gon" operates on the same principle: it emits a stream of hot air before the vehicle to which it is fitted, and a lamp may be so incorporated as to intensify the clear-air beam. The heat is produced electrically and the air stream by a motor-driven fan. It is reported that the London General Omnibus Co. and the Metropolitan Electric Tramways, Ltd., are experimenting with the apparatus.

Copper, Lead, and Rubber Prices.

The Past Two Years' Movements Compared.

FOLLOWING our usual practice we reproduce herewith curves illustrating the course during the past two years of the prices of three materials largely used in the electrical industry. Their prices are given week by week in our "Business Notes" section.

Dealing first with copper, it will be seen that prices ruled higher during the whole of last year than in 1928. nounced during 1929, although it eventually got back to the level at which it started. Apparently in sympathy with copper, and due, also, to an access of buying, the price ran up to £28 10s. per ton in March, but soon settled down again and it showed a falling tendency throughout the rest of the year. In 1928 the variation was confined to very narrow limits.



Copper, Lead, and Rubber Prices in 1928 and 1929.

In 1928 there was little fluctuation, the price having risen gently from about £65 to £76 per ton. At the beginning of last year a sharp upward movement set in, culminating in a jump to over £112 in March. The reaction was swift, and in about a month the price had fallen to £84, from which it hardly moved during the rest of the period.

Variations in the price of lead were also more pro-

The price of rubber has not shown that resiliency which is the chief characteristic of the commodity. When it is recalled that in 1925 it went as high as 4s. 6d. per lb., the past year's level makes one wonder how the producers lived. The price at the end of 1928 must have been the lowest ever reached. It may be of interest to mention in this connection that in 1910, the price of rubber rose to over ten shillings a pound.

Generating Station Accounting.

Comments on the financial regulations issued by the Electricity Commissioners under the Seventh Schedule to the Electricity (Supply) Act, 1926.

By W. E. FODEN, A.S.A.A.
(Financial Controller, Manchester Corporation Electricity Department).

UNDER Section 7 (3) of the Electricity (Supply) Act, 1926, once an electricity generating station is selected and operated by the Central Electricity Board the latter becomes responsible for the "cost of production," to be ascertained in accordance with the Second Schedule to the Act.

Sales by Selected Station Owners to the Board.

Accounting for the sale of energy by the owners of selected stations to the Central Electricity Board is dealt with first. In the absence of special arrangements permitted by Section 7, the normal procedure will be as outlined below.

Costs are to be borne in the first instance by the owners just as in the past, and recovered in full from the Board in accordance with the schedule above-named. As indicated by that schedule, costs consist of the following items in so far as they are properly attributable to the provision, maintenance, and operation of the station, *viz.*:—

All expenditure on fuel, oil, water, stores, repairs, renewals, wages, salaries, superannuation, insurances, rents, rates, and taxes (other than taxes on profits),

a proper proportion of management and general establishment charges,

any other expense on revenue account,

capital charges (on outlays properly incurred) which for local authority undertakers will rest on average interest rate paid and debt redemption provision, and for companies on dividends paid within limits of 5 to 6½ per cent. per annum and depreciation on a scale to be fixed by the Commissioners; interest on working capital is also to be included.

The owners may include allowances in respect of capital assets properly provided at the station out of revenue, which, of course, entail no recurring capital charges to the owners. These allowances will rest on (*a*) average interest rate and average dividend rate for municipal undertakers and companies, respectively, and (*b*) depreciation not yet fixed by the Commissioners. From the foregoing costs, net income from fuel and steam by-products has to be deducted.

The selected station owners will probably be required in the future to make a more exact demarcation of expenses than has been customary as between generation *per se* and distribution, in respect of switchgear and feeders at the generating stations.

The interpretation of the phrase "average rate" of interest paid on the money raised by a local authority for the purpose may give rise to slight doubt because some authorities raise moneys specifically for electricity purposes, and others raise moneys in common for all local government purposes and subsequently make block allocations. It would seem that in the latter case the common rate must perforce apply to electricity allocations.

The arbitrary proportion of expenses common to the selected station owners' whole undertaking—generation, distribution, and sale of electricity—may vary from one owner to another because of the differences in services undertaken (supply of electricity, hire of appliances, &c.), in sizes and areas of undertakings, and in their personnel. For the larger undertakings it would appear that 33 per cent. may reasonably be attributed to generation. For power companies selling in bulk only, a much higher figure may be justified.

In short, the costs of production consist of all net expenses directly and specifically attributable to the provision, maintenance, and operation of the station (no matter under which headings they may appear or under which they may be merged in the Board of Trade form of accounts), plus (1) a proportion of the owners' common expenses of management and general establishment, and (2) the allowances above-named for capital assets provided from income.

It will thus be apparent that concurrently with the well-established accounting needed by the Board of Trade form, sub-divisions of many of the headings in that form will be required to yield the new analysis for (1) generation as defined in the Second Schedule, for (2) high-voltage transmission (where selected station owners' mains are used by the Board) as defined in the Third Schedule, and for (3) distribution and sale to the general body of consumers. Contributions to superannuation funds instead of being regarded as a general expense will have to be specifically apportioned and a proper proportion allocated to the selected stations, to high-voltage mains used by the Board, and to other purposes according to the personnel employed in each field. Similarly rents, rates, and insurance will require specific apportionment and allocation to each field. Over and above these specific allocations the proper proportion to be put against generation will have to be determined arbitrarily in respect of the common management and establishment expenses.

Analysis of outstanding debts of local authority undertakings as between the three fields above-named will, no doubt, have already been made by selected station owners, seeing that nearly three years have elapsed since the 1926 Act was passed, and they will presumably have made arbitrary apportionments of loans raised for a variety of electricity purposes prior to the Electricity Commission being established when "omnibus" loan sanctions were in vogue. Fortunately such loans cannot now be numerous. In the case of companies, capital outlays will, of course, be the basis of reckoning for dividends and depreciation as previously named.

The Board may refuse to accept costs in respect of wages and salaries which are unduly in excess of standard rates fixed by Whitley or trade organisations, in which event such excess costs will have to be borne by the general body of consumers supplied by the owners. Unless the Board adopted this attitude it would be quite easy for the undertaker to disregard all existing trade or Whitley agreements by paying substantially increased wages or salaries, which would, in part, be at the expense of all other receivers from the "grid."

An anomaly will arise in the case of local authority selected stations in that assets lasting beyond the loan redemption period will, on completion of that period, entail no charges for interest and debt redemption

against the Board. Exported energy will thus bear no cost in this connection in the "free" period. Capital assets acquired out of revenue will, on the contrary, entail charges throughout their "life" against the Board immediately use by the Board begins, and in part will, of course, reappear against the owner under Section 7 (4). Debt redemption does not apply to company finance, so that the anomaly named will not occur with them. Local authorities owning selected stations will thus have an inducement to finance capital outlays immediately from revenue rather than from loans under the sinking fund method. They cannot, however, do so for large schemes, because of saddling their own present-day consumers with heavy burdens.

Where, by request of the Board, fuel stocks are carried by a selected station over and above its own requirements, so as to safeguard other stations during possible emergencies, such costs will presumably be recoverable in full from the Board, or from the other stations, outside the accounting called for under the Second Schedule. Fortunately the words "unless otherwise agreed" in Section 7 (4) afford an opportunity of dealing with a matter of this kind which could not be brought within the restricted language of the Second Schedule.

In relation to the Second Schedule it may be noted that the accounting is in total money only, no correlation to kilowatts of demand or to units of output being necessary. If, unavoidably, the selected station be shut down the Board will still bear the expenses named in the Act. Section 4 (5) of the Act provides that de-selection of a station cannot occur without the consent of the owners.

Finally, it may be recalled that, if special arrangements are made by the Board and the owners under Section 7 (3) and (4) for determining the selling price of the station output, all the foregoing accounting will be unnecessary, except as a precautionary measure in case the owners desire to claim the benefit of Section 13. This section provides that the charges to owners by the Board shall not exceed the cost which they would have incurred, had this Act not been passed, in themselves generating a like quantity of electricity.

Sales by the Board to Selected Station Owners.

Accounting for sales by the Board to owners next calls for consideration. Under Section 7 (4) the Seventh Schedule and the Electricity Commissioners' regulations supplementary thereto (which it is understood are to be reviewed after three years), the total moneys debited to the Board by the owners are to be divided by the Board (with assistance from the owners) into two categories (fixed and running) as shown in Table I.

The grand totals emerging from the foregoing analysis will require reduction to unit bases—fixed cost per kW of demand on a moving monthly average demand, and running costs per kilowatt-hour of output. In this connection it has to be remembered the Seventh Schedule provides that the highest figure of demand for owners and Board combined within the year of account shall remain constant for costing purposes from the month of occurrence onward until exceeded.

Up to this point the total costs, their division into fixed and running components, and their reduction to unit bases are in respect of the demands and outputs of owners and Board combined.

The next step will be to reckon charges against owners if based on cost of production and adjusted for load and power factor variations. For load factor variation the adjustment will, of course, result automatically from charging the owners' maximum demand and output at the cost unit bases which emerge from the combined working. Taking imaginary figures for illustration only, combined working may show as follows:—

Fixed cost 45s. (540d.) per kW m.d.

Running cost 0.16d. per kWh.

Load factor 40 per cent. (3,504 hours per annum).

Hence: $$\frac{540\text{d.} + (3{,}504 \times 0.16\text{d.})}{3{,}504} = 0.314\text{d.}$$ average inclusive cost per kWh.

whereas charges to owners (apart from the share of the Board's expenses recovered from owners) would on this basis and with a worse load factor of, say, 35 per cent. (3,066 hours per annum) work out at the higher average inclusive charge per kWh of 0.336d. reached thus:—

$$\frac{540\text{d.} + (3{,}066 \times 0.16\text{d.})}{3{,}066} = 0.336\text{d.}$$

For power factor the adjustment will be made in the fixed costs to meet the difference between station power factor and owners' own power factor. The Commissioners provide a table of coefficients based on correlations of these separate power factors and their variation from the assumed standard figure of 0.8 for which stations are generally designed. These coefficients form the multipliers of the fixed costs per kW, and where the owners' power factor is higher or lower than the power factor at which the station is operated, it will accordingly reduce or increase the fixed costs per kilowatt. To the cost of production thus calculated and adjusted for load and power factors a proper share of the Board's expenses is to be added.

If the cost of production so adjusted and increased by the share of the Board's expenses prove to be higher than the tariff or "grid" price, which is to be fixed by the Board on a non-profit earning basis, the owners will be entitled to be charged at the "grid" price.

They may, however, be able to show under Section 13 that, had the Act not been passed, they could have generated at a still lower cost. The accounting under the Seventh Schedule will obviously be needed, if only to decide whether the benefit of Sec. 13 shall be sought or not.

TABLE I.

Total Costs.	Division.	
	Fixed.	Running.
	Formulæ. Proportion expressed as a decimal:—	
Fuel less net income from sales of fuel and steam by products.	$\frac{100}{100+12.8\ L}$	Remainder.
Oil, water, and stores.	$\frac{100}{100+9.66\ L}$	Remainder.
Salaries and wages.	$\frac{100}{100+0.38\ L}$	Remainder.
Repairs, maintenance, and renewals.	$\frac{100}{100+0.0001\ N\ L}$	Remainder.
(The foregoing items are to include their proper proportions of pensions, superannuation, and insurance of officers and servants.)	where— L is the average load factor of the station as defined in the regulations; and N is the number of hours during which the station was in commission in the year of account.	
Rents, rates, and taxes (other than taxes on profits).		
Proportion of management and general establishment charges.		
Any other expenses on revenue account.		
Interest on money properly expended on capital account.	All.	None.
Depreciation for company owners according to a scale to be fixed by the Commissioners; debt redemption for local authority owners.		

To sum up, charges to owners may be made on one of four bases, *viz.* :—

(1) Cost of production adjusted for load and power factors, plus a proper share of Board's expenses; or	whichever be the lower as permitted by Section 7 (4).
(2) " Grid " or district price fixed on non-profit earning basis; or	
(3) Hypothetical costs of the owners which would have obtained in generating a like quantity of electricity had there been no Act; or	if lower than (1) or (2) as guaranteed by Section 13.
(4) Special arrangement between owners and board.	under Section 7 (3) and (4).

Cash Transactions between the Board and Selected Station Owners.

Regarding cash transactions it will be seen that tentative monthly reckonings—debit and credit—are provided for by Section 7 (5) of the Act. The Board will presumably remit monthly for estimated net amounts due to owners, leaving final adjustments to be made at the year end. No doubt the first year's adjustments will take much time and owners will have to close their annual accounts on approximate or suspense reckonings with the Board, leaving contentious matters for subsequent settlement.

Accounting Disputes between the Board and Selected Station Owners.

Section 7 (6) enacts that if any question between the Board and the owners of a selected station arises under this section, then, if it relates to the cost of production, it shall be determined by an auditor appointed by the Minister of Transport, and in any other case it shall be determined by the Electricity Commissioners.

General.

The foregoing accounting vitally affects the owners of the selected stations within the schemes already published for Scotland, England, and Wales. Furthermore, the purchasers of bulk supplies and railway traction supplies are concerned with the costs falling under the Seventh Schedule on owners, because these costs will govern charges to them (apart from transmission charges) in the event of such supplies being given direct by selected station owners, under post-1926 contracts. In this connection it should be noted that a direct supply from a selected station would be an indirect supply by the C.E.B. under Section 12.

The position of bulk supply and railway traction purchasers in respect of the accounting at the selected stations appears to be :—

(1) If purchasing under pre-1926 agreements, the accounting will be of no interest to the purchasers, or

(2) if purchasing under Section 12, the purchasers will be entitled to charges at the same rates as charged by the Central Electricity Board to the selected station owners (with due adjustments for load and power factors), plus the transmission costs; these rates in turn will be one of the four bases outlined in the earlier part of this article when dealing with sales by the Board to owners.

The accounting for sales and purchases by the owners as sketched above necessarily rests on an annual basis, as recognised by Section 7 (5). It is anticipated the Board will fix its financial year as the calendar year.

The financial interest of the owners in the final reckonings will lie immediately in (*a*) the energy generated for the Board in excess of the owners' requirements which has appropriately been termed " exported energy," (*b*) improved load factor reducing unit costs for both the Board and the owner, (*c*) reduction in individual stations, spare plant through interconnection of stations in the area, thus reducing fixed costs, and (*d*) differences between the owners' own power factor and the power factor at which their station will be operated under the Board's direction. Ultimately as the objects of the Act are more fully realised there should, of course, be other benefits to owners from use of electricity becoming general in new spheres—industrial, public, and domestic—and from standardisation and cheapening of electrical appliances through mass production, in turn enlarging the demand for electricity from consumers.

Non-Selected Station Owners in Account with the Board.

It is outside the scope of this article to forecast the accounting for non-selected stations when costs will be called for by the Board in cases where its interference can be proved of benefit to the owners of this class of station. Furthermore, the Commissioners have given no indication how the costs should be compiled. It is, however, worth noting that in comparing cost of local generation with cost of the Board's intended supply, capital charges on the local generating plant are by direction of the 1926 Act to be excluded. As compensation may be payable to officers and servants on the closing of the owners' station, the margin between charges by the Board and owners' costs ought, in common fairness, to be at least sufficient to meet the cost of compensation. The Act does not provide for compensation being regarded as part of the " then " cost of generation, but if the margin were insufficient the owners would clearly be prejudiced.

Accounting Summary in Chart Form.

For convenience of reference the accounting is set out in the following Table II :—

TABLE II.

References to the 1926 Act.	Charges to C.E.B.
As *sellers* to the C.E.B. under selected station working, one of the following two bases:	
Section 7 (3) and Second Schedule.	1. Whole cost of production (no matter how analysed in Board of Trade form of electricity supply accounts) which can specifically be traced with limit for companies to dividends and depreciation, plus a Proper proportion of common management and establishment expenses, and plus Allowances for interest and depreciation on capital assets purchased out of income, or
Section 7 (3)	2. Special arrangement may be made between C.E.B. and owners
As *purchasers* from the C.E.B. under selected station working, one of the following four bases:	
Section 7 (4)	1. After determination of charges to the Board as shown above, and their division into fixed and running categories under formulæ prescribed by Electricity Commissioners, the resultant compound cost of production (adjusted for differences between load and power factors of owners and C.E.B.) together with a proper proportion of the Board's expenses, shall be charged to owners; or
	2. The " Grid " price for the District, if this be lower, shall be charged; or
Section 13	3. If the owners can show their cost of production would have been lower than the charges by the C.E.B. had the Act not been passed, the charges shall be adjusted accordingly, or
Section 7 (4)	4. Special arrangement may be made between C.E.B. and owners.
As *purchasers* from the C.E.B., on compulsory closing of non-selected stations:	
Section 14 (3)	At a price which shall be less than the owners' cost of production, exclusive of capital costs (though not provided for in the Act, the margin between charges and cost should be sufficient to cover cost of compensation payable to displaced officers under Section 15).

The Radiological Exhibition.

Finality in design is far from being attained; apparatus is, with some exceptions, being built increasingly on engineering lines; electrical safety is also a noticeable feature.

By E. H. W. BANNER, M.Sc., A.M.I.E.E. A.Inst.P.

(*Concluded from page* 12.)

Friday morning, December 6th, was devoted to papers of general engineering interest. Mr. W. E. Schall commenced with "A Single-Valve Plant for Diagnosis and Deep Therapy." This was a description of the set, fig. 12, already detailed under the heading of Messrs. SCHALL & SON'S exhibit, and little more can be added. The requirement of such a set is based, Mr. Schall said, on the impossibility of producing an efficient transformer to cover such a wide range of both current and voltage as is required for the opposing needs of radiography and therapy, and so the increased voltage for the latter is obtained by using a valve and two condensers to double the transformer voltage; this is entirely distinct from the use of condensers for smoothing purposes. The diagrams, figs. 13 and 14, show in outline how the connections are changed.

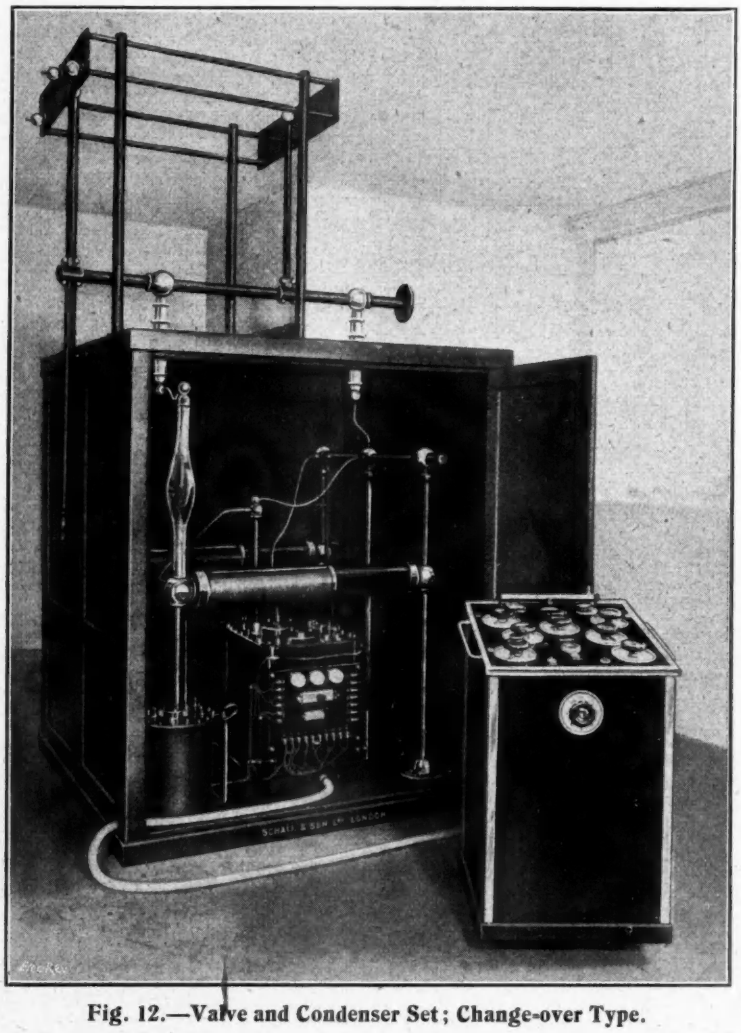


Fig. 12.—Valve and Condenser Set; Change-over Type.

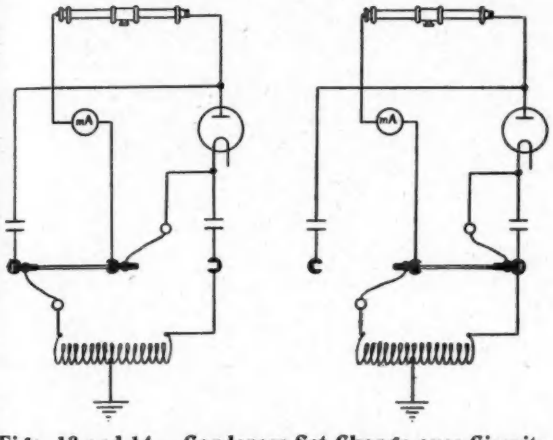
Next Mr. Cuthbert Andrews exhibited a film entitled "A Mobile X-ray Unit." This was a set carried in a one-ton motor van, but actually assembled and used in a building, such as a patient's house. The van provides the power unit and a trailing cable carries the low voltage to the room and the transformer. A telephone between the control board and the driver's seat is included. A developing room on the car enables results to be quickly obtained; the time to the film examination from the time of arrival at the house is given as half-an-hour. The set is rated at about 30 mA at 65 kV peak. X-RAYS, LTD., are the manufacturers and a Morris one-ton van is used.

A paper entitled "Modern Radiological Developments in Germany, with special reference to the new Institute at Frankfurt" was read by Dr. Ffrangcon Roberts. This dealt with an immense installation and showed on what a large scale X-ray apparatus is used in that country. A special building has various rooms for different classes of radiography, so that no adaptation is necessary, each set being used solely for its designed job. The power plant is mounted on a mezzazine floor out of reach of the operating rooms, all high-voltage leads being brought vertically direct to the apparatus in the diagnostic and treatment rooms.

Dr. A. Oriansky then dealt with the "Output of Transformers under Different Methods of High-voltage Rectification," his main conclusions being that, assuming a single-valve set to be 100 per cent. efficient, the relative values for other methods of rectification were: self-rectified, 98 per cent.; four-valve set, 97 per cent.; and mechanical rectifier, 80 per cent. Of these efficiencies about 2.5 per cent. of the total voltage drop is lost in the rectifier of a single-valve set, whilst with a mechanical rectifier the voltage drop increases to 6.25 per cent. Against this he had found that results from a mechanically rectified set presented greater contrasts. This is probably due to the fact of the selective rectification of such a rectifier, in which the lower and radiographically useless voltages are eliminated. He concluded that there was very little real difference in results between the various methods dealt with.

Mr. W. R. Gray described the new rotating anode tube of Messrs. PHILIPS LAMPS, LTD. The illustration of sec-

tions of the tube given in a previous instalment, p. 1127, fig. 1, will show the leading features, which are as follows: A is the copper anode having a "target" W of tungsten, which is a ring embedded in the anode. The inclination of this is at 19 degrees to the normal to the kathode stream, so that, although the area exposed to the kathode bombardment is shaped as at F, the effective focal spot is almost a minute square, giving very fine definition with the working area of the increased area F. K is the kathode and represents a helical filament. The anode A rotates on the central pin C and is driven by the eddy currents induced in the anode and assisted by the iron ring E, which virtually form the rotor of an induction motor. The stator winding S is entirely outside the



Figs. 13 and 14.—Condenser Set Change-over Circuits.

tube, and one point of it may be earthed. Either a three-phase winding or a double winding for a split-phase single-phase supply can be supplied. The construction is otherwise very similar to that of the "Metalix" tube of this firm's manufacture. The speed of rotation is arranged to be about twenty revolutions per second.

The need for this tube is that modern technique demands good definition of the radiograph, attained by using a small focal spot, and heavy load capacity in order to minimise exposure times. Mr. Gray stated that the maximum loading permissible was about 200 watts per square millimetre per second, and if the temperature was required to be halved the loading or the exposure must be a quarter, following an inverse square law. In order then to increase this loading, whilst retaining the same focal area, the anode may be moved, and in the tube described a rotation is used.

The author pointed out that in order to increase the load capacity n times during the exposure the anode must travel through a distance of n^2 times the focal width in the direction of rotation.

Tests on tubes with rotating anodes have shown that, for a given exposure, the loading may be ten times that permissible with a standard tube with a stationary anode.

Other important papers included the tenth Mackenzie Davidson Memorial Lecture, delivered on December 4th by Professor Gösta Forssell, President of the Swedish Radiological Institute, his subject being "Radiotherapy of Malignant Tumours in Sweden." The same evening a meeting of medical members was held at the Institute buildings in London, when Dr. G. B. Batten opened a discussion on "The Requirements of Clinicians from Radiologists and *vice versa*."

On December 7th discussions took place on "Aspects of Radiation Therapy" and "The Use and Abuse of Radium Needles." Professor A. S. Eddington, F.R.S., delivered the twelfth Silvanus Thompson Memorial Lecture in the evening, his subject being "X-Rays in the Stars."

Further medical papers were read by Dr. E. J. H. Roth on the "Mekapion," an ionisation apparatus for the absolute measurement of X-ray dose, and three by Miss S. F. Cox and Dr. F. G. Spear on (1) tissue culture and its application to radiological problems, (2) the action of X-rays on living cells cultivated *in vitro*, and (3) the immediate and delayed effects of radium on tissues cultivated *in vitro*.

Electricity for the Home.

Some impressions of the domestic development work of a large metropolitan electricity undertaking; new manufacturers' items.

Progress at St. Pancras.

FOR general domestic supplies the St. Pancras undertaking claims to have the lowest tariffs in Great Britain and Ireland. Lighting may be obtained on a flat rate of 3d. per kWh, and heating and cooking at a similar rate for ½d. per kWh. Some idea of the progress made by the department may be obtained from the fact that during the past financial year the sales of electricity for cooking and heating increased by 44 per cent. over the preceding year.

The area served by the undertaking is a very mixed one, and consumers of the richest and poorest classes are on the mains. Much of the success of the concern in the domestic field is attributed to the fact that the supply concern is very careful to ensure that no prospective consumer is taken on unless there is every prospect of his becoming a satisfied consumer.

The department advocates the simplification of water-heating apparatus, and believes that there is a large and profitable field of work to be covered in the conversion of existing hot-water installations with thermostatic control in ordinary dwellings. By way of illustrating the practical nature of the proposition from the consumers' viewpoint, which must also be the suppliers' viewpoint, a 4-kW immersion heater in a 15-gal. local storage tank results in 15 gal. of water at 150 deg. F. in about one hour; with the addition of 10 gal. of cold water there is 25 gal. of bath water at a suitable temperature for 2d. It is emphasised that tanks should be carefully examined before putting in immersion heaters; sometimes disturbance renders a new tank necessary.

Fig. 1.—A "Baby" Cooker as used at St. Pancras.

St. Pancras has some regard for the use of low-loading immersion heaters fitted in a well lagged tank of 20 gallons which can be left on circuit permanently. For an

average middle-class home is suggested a loading of 500 W, which can be supplied, at ½d. per kWh, for 3s. 6d. per week, or, say, £2 per quarter. This is not an unreasonable figure; and the load factor is 100 per cent.

For use over sinks (not baths) St. Pancras advocates the electric geyser, with a loading of not more than 4 kW, and particularly for use with the electric cooker to overcome the boiling-plate trouble. Gas undertakings depend on the use of the gas geyser for a large

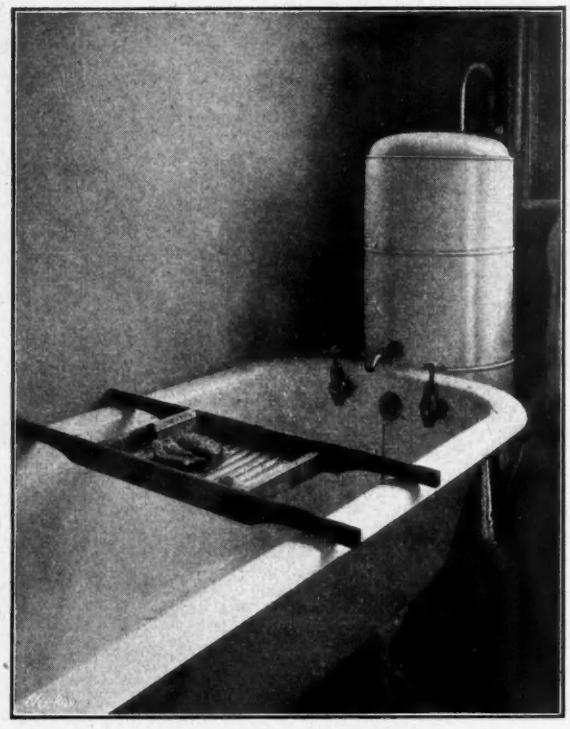


Fig. 2.—A St. Pancras Bathroom.

amount of their revenue, and without the electric geyser the electrical industry has nothing successfully to compete with the popular appliance of the gas service. The geyser is unique in that it will at all times give instantaneous supplies of very hot water. By this method, at ½d. per unit, 30 washes can be obtained for 1d.

The undertaking has hired out a number of self-contained pressure-type automatically-controlled calorifiers, and these are installed wherever practicable for domestic hot-water supply to serve a number of taps from the central storage for public and office lavatories, hairdressers, nursing homes, &c.

With regard to electric domestic heating the undertaking is of the opinion that ultimately by means of hot-water radiators or tubular heaters heating will be used to a very large extent. It lends to low loadings over long hours. There is no fire risk with hot-water radiators, and even heating effect is obtained; equipped with thermostat control the system approaches the ideal. The " Genii " type of room-temperature control is considered particularly suitable for this work. Considerable hiring-out of electric fires is done by the undertaking, and the " Bungalow " type fire is popular. 2,300 fires are out on hire at present, and the hire charges are from 1s. 6d. per quarter.

As regards electric cooking the department prefers to deal only with people who are enthusiastic. The " Baby " type of cooker, fig. 1, is very popular at St. Pancras for use in flats and small dwellings. It is a small complete and compact cooker, capable of doing all the necessary cooking (boiling, frying, grilling and roasting) for a family up to four in number. It is very simple and efficient.

It seems that other forms of fuel at St. Pancras are now having a very bad time. On the Holly Lodge estate there are some 400 cookers in use. Very few cookers have been returned during the past few years. It is believed that much of the difficulty of the boiling plate can be got over by the use of the closed type, and by educating consumers as to its proper use: what appears to be lost when first switching on can be got back at the end. It is also considered essential to use good flat-bottomed cooking utensils, and consumers should also be educated up to this. Figs. 2 and 3 are two interesting views of electrical equipment in typical consumers houses. In the bathroom the storage heater is of the " Genii-Vectis " type, with a loading of 4 kW, and controlled by a 3-heat switch.

The cooker in the kitchen is of the " Moorwood " type. This is suitable for a family of 6-8 persons and has a total loading of 5 kW. The geyser is of the " Genii " type and is loaded at 4 kW.

Electrically-warmed Blankets and Pads.

The products of THERMEGA, LTD., 94, Petty France, Westminster, S.W.1, " Thermega " blankets and pads, are worthy of special mention for two reasons. They are useful electrical appliances, and they are made by disabled ex-Service men through an organisation which is financed and controlled by the Ex-Service Welfare Society, of which Sir Frederick Milner is president. The standard blanket measures 44 in. by 32 in. The material is doubled, and between the folds a flexible conductor is arranged in parallel lines at between 2½ and 3 in. apart. It is claimed that the element is so pliable as to be practically indestructible. The blankets and pads are suitable for all voltages from 100 to 250 V, and are thermostatically controlled. The loading of the appli-

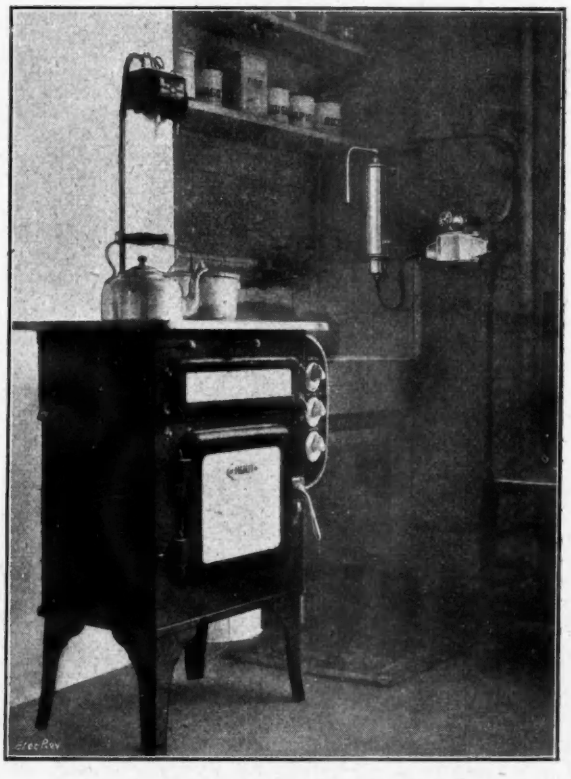


Fig. 3.—In a Typical St. Pancras Kitchen.

ances varies, according to size, &c., from 50 to 85 W. The blankets are made to reach a temperature of approximately 105 deg. F. within an hour. Special blankets with varying rates of warming up can be supplied to meet specific medical requirements. The pads, however, will heat up immediately, the small-size pad giving one constant heat (125 deg. F.), whilst the large-size pad, with its regulator switch, allows of three definite degrees of heat: namely, 90 deg., 120 deg., and 150 deg. F. The temperatures stated are

attained when the blankets and pads are "covered"; *e.g.*, not exposed to the air. Each appliance is fitted with 8 ft. of flexible lead and with a lamp socket adaptor. A detachable and adjustable two-prong wall plug suitable for any wall socket can also be supplied, and also a two-way light and heat adapter for bedrooms with a single lamp without a wall plug. A handy press-button switch is another extra which can be obtained.

A Novel Electric Heater.

The "Dome" electric heater, fig. 4, is an invention of Mr. E. Nuttall, Blackmore End Lodge, Wheathampstead, Herts. It is constructed in the form of a dome of refractory material, and the windings of helix resistance wire are laid circumferentially in grooves on the surface in rising tiers. A feature of the invention is

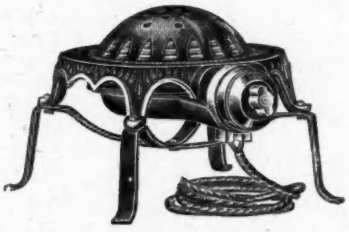


Fig. 4.—A "Dome" Electric Heater.

the separation of the dome into quadrants or sections which are internally clamped together, but individually wound with resistance wire. This formation makes it possible to hold the resistance wire securely during the periods of high temperature when expansion is most liable to cause "shorting" of the wires. As the dome has double the area of a circle of its largest diameter, it gives twice the space of the circle for winding purposes. In operation the vessel containing the liquid to be heated is recessed to accommodate the heater and consequently, it is claimed, the heat is fully conserved. With the heating unit described it is possible to use pans, kettles and urns of widely differing capacities, and when the ring is not in use for cooking purposes it makes a good electric fire of novel design, radiating heat in every direction. The apparatus is manufactured by the Express Electric Heating Co., and we understand that works will be erected in North London for the production of the various designs. The heater illustrated has four sections with a total loading of 2,000 W. Three-heat control is provided.

"All-Electric" Houses at Eltham.

We have received from Woolwich Borough Council a brochure issued in connection with the opening recently of the Eltham housing estate. Both the streets and the houses are lighted by electricity, there being no gas on the estate. Of the 2,186 erected, 847 are "all-electric," with the exception of a slow combustion stove in the scullery. The electrical equipment includes heating plugs and radiators and a wash-boiler. Electric cookers are supplied on hire by the Council's Electricity Department at 7d. per week.

The tariffs for electricity are very low, representing, on the maximum-demand system, a weekly charge of 1s. 3d. plus ½d. per kWh for all electricity consumed. Irons are supplied on hire at a charge of 1d. each per week.

The Council has also adopted a system whereby tenants may have extra plugs on payment of 1d. per plug per week over a period of 7 years. Electric radiators and other apparatus to a value of £4 are also supplied at the request of the tenants, on payment by instalments of 6d. per week.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Registered Electrical Contractors.

Applications for registration from the following were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting:—

Douglas, A. H., Higher Broughton, Salford.
Burgess, A., Stalybridge.
Langley, F. W., & Co., Henley, Stoke-on-Trent.
Westaway, J., Northenden, Ches.
Coupland, V., Hull.
Jones, Peter, Ltd., Sloane Square, S.W.1.
Cornall, Thomas, Ltd., Bury.
Morgan, E. G., Ystrad Mynaeth, Glam.
Ive, L. J., Watford.
Coulchan, J. C., Hull.

At the same meeting two applications were declined.

Contractors as Retailers.

This month's issue of the official organ of the Electrical Contractors' Association, and its allied bodies, bears the title "The Electrical Contractor and Retailer." Explaining the reasons for the addition to the title, the Editor says that electrical contractors generally are now paying more attention to the sale of appliances, although some of the older firms "still continue to cling to engineering traditions." With the introduction of reasonably low heating rates and "all-in" tariffs, the restrictions on the free use of domestic apparatus have, in a large measure, been removed, and the electrical contractor has quickly seized the opportunity thus provided for profitable retail trading. "As time goes on, the general run of electrical contractors will find that shop-sales and showroom demonstration will occupy the bulk of their time and provide the bulk of their profits. It is reasonable to believe that there will always be room for the specialised engineering firm. It is probable that theatres, kinemas and big lighting, heating and cooking jobs will continue to be handled by contractors not seriously immersed in retail salesmanship; but . . . the rank and file of the trade must take up the retail side of the business or sink into oblivion."

Conditions in Sweden.

The *Swedish Economic Review* (the official journal of the Swedish Board of Trade) states that, in general, employment showed a further improvement during the third quarter of 1929. There is said still to be a very great shortage of skilled labour in the mechanical industries and the shipyards. This also applies in places to the electrical branch, in which possibilities of employment seem to have increased considerably during the quarter. Exports as a whole increased, although in the case of electrical machinery there was a decline in the first ten months of the year as compared with the corresponding period of 1928. The actual total was 26,654,000 kr. (£987,000), as compared with 36,692,000 kr. (£1,359,000). The value of exported telephone and telegraph apparatus was 11,222,000 kr. (£415,600), against 11,144,000 kr. (£412,700).

According to statements ascribed to Mr. Wincrantz, director of the L.M. Ericsson Company, the stock of orders on hand at the end of of 1929 was greater than at the close of the previous year. At all the company's works in Sweden the value of the orders on hand is about 30,000,000 kr., of which over one-half is for export markets. The foreign works which co-operate with the company reported an increase of 76 per cent. in the orders booked last year, and the stock of orders at the end of 1929 was larger by 60 per cent. than at the close of 1928. In the case of the Allmänna Svenska Elektriska, A.B., it is stated that the works at Västeras are fully occupied and actually have more to do than they can perform within the allotted time. The company's exports have considerably increased, and the situation is said to be very satisfactory.

A Polish Transport Exhibition.

We have received from the Polish Consul-General in London (2, Upper Montague Street, Russell Square, W.C.1) particulars of the International Transport Exhibition which is to be held at Poznan (Posen), Poland, from July 6th to August 10th. This will be arranged in buildings with a total floor space of 750,000 sq. ft. and divided into a number of classes. In addition to sections devoted to railway, sea, and air transport, there will be sections covering urban transport (tramways, underground railways, &c.), telephone and telegraph apparatus and installations, radio and television, and factory transport. During the run of the exhibition the world congress of the international association of consumers of transport material ("Union Internationale de Transport en Commun"), which represents an annual buying power of 400 millions sterling, will be held. In some notes upon Polish trade and industry, it is stated that the electrification of eight new provinces is now under consideration, involving the partial electrification of the Polish State Railways. During 1928 the Poznan Electric Tramways Company purchased material abroad to the extent of £600,000, and there are ten other cities with electric tramways, including Warsaw. Most of the radio apparatus is imported and all Poland's broadcasting stations, with the exception of Katowitz, are being refitted with more powerful plant. It is also stated that 90 per cent. of the Polish telegraph and telephone installations employ foreign apparatus. The office of the exhibition is at 18, Focha, Poznan, Poland.

The Value of the D.O.T. and F.B.I.

Speaking at last week's annual meeting of Agricultural and General Engineers, Ltd., the chairman (Mr. G. E. Rowland) said that the Department of Overseas Trade, and its officials at home and abroad, as well as those of the Federation of British Industries, had helped the organisation materially, and he sometimes wondered if the facilities and help which those great institutions could and did give to British exporters were as fully known or appreciated as they should be.

Mr. Rowland also stated that the export sales organisation was now in full operation. Their overseas branches in Argentina, Chile, India, Australia and Africa were ably directed and were making very satisfactory progress. A branch in New Zealand would be opened in January. Most of the other markets were being visited and worked by first-class representatives, while at home the organisation was equally energetic and capably directed.

New Catalogues and Lists.

Messrs. BENHAM & SONS, LTD., 66, Wigmore Street, W.1.—An illustrated folder outlining the advantages of "Electro-Vapour" radiators.

WRIGHT (ELECTRIC POWER SPECIALITIES), LTD. (late Wright Motors, Ltd.), Century Works, Halifax.—List No. 72, describing the Creedy high torque, single-phase commutator motor, which the company is manufacturing under licence. Also price lists illustrating single-, 2- and 3-phase motors, d.c. motors and dynamos.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—List No. 410, giving dimensions and prices of conduit and conduit fittings.

Messrs. SAMUEL OSBORN & Co., LTD., Clyde Steel Works, Sheffield.—An illustrated folder drawing attention to the "S.O.B.V." cutting steel alloy.

IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.4.—Two leaflets advertising the Igranic-Pacent 12-watt power amplifier and radio components.

Messrs. WARREN BROTHERS (MIDDLESBROUGH), LTD., Prudential Chambers, Middlesbrough.—A well-produced and illustrated brochure, describing Howard's patent steam separator; also a list of ships in which these separators have been installed.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—A leaflet illustrating some examples of "Simplex" signs.

RELAY AUTOMATIC TELEPHONE CO., LTD., Marconi House, Strand, W.C.2.—The January number of "The Relay Recorder" contains a number of interesting articles in addition to notes on the company's activities.

UNITED ENTERPRISES, INC., 13100, Athens Avenue, W., Cleveland, Ohio, U.S.A.—An illustrated pamphlet advertising the reconditioned electric vacuum cleaners of many leading makes which are supplied by the company. Also views of the company's works.

Messrs. E. SHIPTON & Co., LTD., 2-3, Caxton House, Tothill Street, Westminster, S.W.1.—A brochure illustrating the Shipton automatic telephone system.

CONSOLIDATED PNEUMATIC TOOL CO., LTD., 170, Piccadilly, W.1.—A pamphlet, prepared more particularly for the company's South African market, describing its C.P. rock drills.

BRITISH PORCELAIN CO., LTD., 343, Abbey House, 4, Victoria Street, S.W.1.—A comprehensive catalogue (pp. 255) in a strong blue leatherette binding, dealing with porcelain insulators, &c., for overhead lines. Fully illustrated.

Mr. D. M. LUMSDEN, Millburn, Almondbank, Perth.—An illustrated pamphlet describing the "Lumsden" sun lamp for use in the home: also a price list of "Lumsden" lamps and accessories.

Messrs. FRY'S (LONDON), LTD., 24-26, Water Lane, E.C.4.—An illustrated pamphlet drawing attention to a small ball-bearing saw bench which the company has recently produced.

Messrs. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—An illustrated price list of electrical accessories.

Messrs. L. G. HAWKINS & Co., 30/35, Drury Lane, W.C.2.—The first number of the new series of "The Link" includes suggestions to dealers for increasing their January sales, and notes on the company's activities and products. A folder is also included giving particulars of the "Hera" electric washing machine.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—List No. 181 L giving prices and voltages of "Argenta" opal lamps.

Messrs. DE BRUNNER & LANG-SIMS, 3-4, King Street, Covent Garden, W.C.2.—A reprint of an article from the ELECTRICAL REVIEW, describing the company's specially designed cooking utensils.

Messrs. A. P. LUNDBERG & SONS, 477 to 489, Liverpool Road, Holloway, N.7.—Illustrated and priced leaflets of the company's tumbler switches.

Book Notices.

"The *Wireless and Gramophone Trader* Year Book and Diary, 1930." (400 pp.) London: The Trader Publishing Co., Ltd. Price 5s. 6d., post free (with a reduction to subscribers to "Trader" publications).—In this new edition no distinction has been made between radio and gramophone firms except in the case of factors. The credentials of radio factors have been carefully scrutinised before including them in the directory. A new feature is a *précis* of the terms of the new Marconi licence.

"The Electrical Engineer's Year Book, 1930." (Pp. 478+ diary.) London: S. Davis & Co. (Aldwych), Ltd. Price 21s. post free.—The 22nd edition of this publication covers all branches of electrical engineering, including generation, distribution, contracting, manufacturing, &c. Official rules and regulations are also given, and a useful list of supply authorities in the British Isles, with consumers' voltages, electricity charges, &c., is included, together with a list of streets in the Metropolitan area in which mains are laid. The matter has been brought up to date, but the general scheme is similar to that of previous editions.

"Electrical Wiring and Contracting." Vol. I, edited by H. Marryat. Pp. viii+256; illustrated. London: Sir Isaac Pitman & Sons. Price 6s. net.

"Electric Overhead Travelling Crane Design," by W. A. Barson. Pp: vii+120; figs. 41 and 11 tables. London: Crosby Lockwood & Son. Price 15s. net.

"Individual Understanding," by E. Garcke. Pp. 40+383. London: Electrical Press, Ltd.

The Australian Tariff.

A Sydney (N.S.W.) correspondent of *The Times Trade and Engineering Supplement* says that Australian manufacturers generally, while expressing great pleasure at the New Australian tariff, regard it only as a first instalment of higher duties. The president of the Associated Chamber of Manufacturers states that in many directions the new tariff will lead to increased employment, while no increase will be made in the prices of locally-made goods. "In fact, many employers are of opinion that they will be able to reduce existing prices owing to the increased output which must follow higher protection." The acting-secretary of the Metal Trade Employees' Association (Mr. D. M. McDonald) looks forward to the employment of a total of at least 50,000 persons in the metal trades section. He said that during 1928 imports of machinery, metals, and metal manufactures amounted in value to £42,801,926, of which goods worth at least £30,000,000 could have been made in Australia.

Ruston & Hornsby's Good Year.

Messrs. Ruston & Hornsby, Ltd., Lincoln, state that their various works operated full time during 1929. The amount of work passing through the oil-engine shops was well up to the average of previous years. Among the more important orders of the year were the following:—Vertical oil engines for the generators at the Brookman's Park station of the B.B.C.; fourteen vertical crude-oil engines for the South Essex Water Board; three vertical type engines for Suva (N.Z.); and marine engines for various vessels. The excavator works received several large orders, including one for a giant electrically-operated shovel, weighing 380 tons, for the London Brick Co. and Forders, Ltd. Another electrically-operated shovel supp'ied

for brickyard development weighed 230 tons. Electrically-driven shovels have also been supplied to Australia. Satisfactory business is reported for most of the other departments.

New League of Nations Buildings.

We have received some particulars from the League of Nations of the new buildings which it proposes to erect. They are to comprise a great assembly hall, secretariat building, and a library. As it is impossible to advertise the contract in the Press of all member States, it has been decided to establish a list of approved firms in all trades. Firms which wish to be registered should forward to the Secretariat of the League of Nations, as soon as possible, their names and references, indicating exactly the work for which they desire to compete. Approved firms will be invited to tender for work in each trade or group of trades in due course.

An Indian Electrical Installation.

The new building for married police sergeants' quarters, Lall Bazaar, Calcutta, is three storied and contains 20 sets of quarters for married inspectors and sergeants as well as accommodation for 34 bachelor sergeants, which includes a recreation room. In addition, the ground floor contains a spacious drill hall. The whole installation comprises 311 light points, 115 fan points, and three electrically-driven centrifugal pumps for water supply. The supply is at 440 V d.c., and is brought from the supply company's mains to three separate main boards within the main block and by a fourth service to the pump house. At each of the main boards the service is divided into 220-V circuits each being controlled by an ironclad switch, the switches and meters being assembled on a special angle iron frame-work. From the main boards, sub-mains in "Henley" wiring system on teak wood battens are run to ironclad Home Office type distribution boards supplied by the General Electric Co. (India), Ltd. All the circuit wiring also is "Henley" wiring system on teak wood battens. Switches, ceiling roses and lampholders are of bakelite, and were supplied by the General Electric Co. (India), Ltd. The fans are Verity's "Ceylon 1928" pattern supplied by the Russa Engineering Works, Ltd.

Police Sergeants' New Quarters, Calcutta.

A special feature of the wiring is that all staircase and compound lights are wired on circuits separate from those serving the quarters, &c. As the building is in the same compound as other large police buildings, the pumping arrangements for all the buildings have been re-arranged and centralised in the new building. Each of the two filtered-water pumps is manufactured by Messrs. Mather & Platt, Ltd., of 10,000 gallons per hour capacity, and the unfiltered water pump is a Worthington pump of 3,000 gallons per hour capacity. The electrical work was carried out by Messrs. Geo. Rosamond & Co., to the layout and specification of the Public Works Department under Mr. J. D. A. Vincent, M.I.E.E., Executive Engineer, Electrical Division.

Great Britain's Radio Exports.

During November last radio apparatus to the value of £103,114 was exported by Great Britain, including valves valued at £21,650. The most important customer was the Netherlands, whose share was valued at £11,441, including valves £126. The Irish Free State was a close second with £11,214 (valves £2,935), and the following were also good markets:—India and Burma, £8,264 (valves £888); Italy, £7,090 (valves £342); Australia, £6,794 (valves £2,649); and Poland, £5,504 (valves £2,409).

German Tariff Reductions.

The import duties on the following classes of goods upon importation into Germany were reduced as from December 31st:—Electric smoothing irons, from 60 to 30 Rm. per 100 kg.; and opal glass, from 120 to 60 Rm. per 100 kg.

Calendars and Diaries.

The DAVENPORT ENGINEERING CO., LTD., Bradford, retains its familiar cooling-tower design in its 1930 calendar, and as usual a block of daily slips is provided.

A neat thin-paper pocket diary has been sent us by the STANTON IRONWORKS CO., LTD.; it contains a good deal of useful technical information.

The 1930 calendar of the LONDON ELECTRIC WIRE CO. AND SMITHS, LTD., Church Road, Leyton, E.10, bears a block of large daily slips full of wise saws and modern instances.

A wall calendar with serviceable monthly date slips has reached us from POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.

A neat propelling pencil, with clip, has been sent us by the WARDLE ENGINEERING CO., LTD., Elsinore Road, Old Trafford, Manchester.

"The Shepherdess," the subject of a combined letter rack and calendar received from the LANCASHIRE UNITED TRANSPORT AND POWER CO., LTD., is a charming rural scene of a maid attending her flock of sheep.

Mr. G. P. COSWAY, Princes Street, Coton Road, Nuneaton, has sent us a monthly wall-calendar with bold figures, illustrating above the "Dred-Nort" link disconnecting box.

An illustration of the Hôtel de Ville, Abbeville, from a cleverly executed drawing by Mr. N. D. Blagdon-Phillips, is the subject of this year's calendar from the PHILLIPS-HENDERSON CO., Bekins Building, Vancouver, B.C.

SAULTER'S PATENT COILING DEVICES, 240, Lower Road, S.E.8, have sent us a very neat wall calendar with monthly slips, the last slip containing useful postal information.

Mr. SAMUEL BAXTER, 102 & 110, Greyhound Road, W.6, has sent us a neat calendar with bold-figured daily slips.

A wall calendar with monthly slips has been received from Messrs. F. W. MAUL & Co., 21-22, Chapel Street, Milton Street, E.C.2, with provision on each slip for noting engagements.

A pad of daily slips below illustrations of a travelling crane and a waste heat boiler manufactured by the firm, form the calendar received from Messrs. JOSEPH ADAMSON & Co., P.O. Box 4, Hyde, Cheshire.

The "SOLUS" ELECTRICAL Co., Judd Street, W.C.1, has sent us a calendar of monthly slips mounted on a neat green card.

A metal calendar, covering the years 1931-41, has been received from the NOX ELECTRIC CO., LTD., Clarence Road Works, Hunslet, Leeds. It has a novel date-indicating device, in the form of a representation of one of the company's lamps.

A wall calendar with monthly slips and illustrations of "Genacco" electrical accessories has been sent by the GENERAL ACCESSORIES CO., LTD., 18-22, Euston Buildings, N.W.1.

A calendar bearing a pad of daily date slips has arrived from Messrs. ROPER BROS., 5, South Anne Street, Dublin.

A neat and serviceable desk blotting pad has been sent us by the HART ACCUMULATOR CO., LTD., Stratford, E.15. Each sheet bears a 1930 calendar.

We have received a calendar from the KOCH & STERZEL A.G., Dresden, illustrating one of their current transformers. It has a block of daily slips (in German).

An example of "Supastone" three-ply lighting glassware is illustrated on the 1930 calendar of the WHOLESALE FITTINGS CO., LTD., 23, Commercial Street, E.1.

A handsome little diary bound in blue fabric has come from the WELIN-HIGGINS CO., LTD., Grosvenor Road, Coventry. Very ample space is provided in this.

A set of cards for their moving-ring calendar has been sent by Messrs. HOPKINSONS, LTD., Huddersfield.

A useful desk memoranda pad has been sent us by INVENTUM ELECTRICAL APPLIANCES, LTD., Park Royal Road, N.W.10. This is of the "Printator" type with a stylus.

"My Lady," the subject of the 1930 calendar of Messrs. HASLAM & STRETTON, LTD., Tredegar Street, Cardiff, is very handsome and finely drawn.

A serviceable desk diary has been received from the UNITED STEEL COMPANIES, LTD., Sheffield.

The American Westinghouse Interests in Japan.

It is reported from Yokohama that the International Westinghouse Company has transferred the rights of the Westinghouse Co. of Japan, to the Mitsubishi Company. This appears to be the outcome of the increasing Japanese preference for products made in Japan.

The Schoolboys' Exhibition.

At the *Daily Mail* Schoolboy's Exhibition, which concluded on January 8th, the GENERAL ELECTRIC CO., LTD., had two large stands on which were exhibited a wide range of the company's products.

Foreign Enterprise in Chile.

Following upon reports that a number of electric power companies in Chile had been acquired by foreign firms, the Minister of Foreign Affairs informed the United Press Agency recently that: "The Government regards foreign co-operation in our industries with sympathy, but in this class of activities it desires that they shall remain in the hands of national firms. The Government will give national companies every kind of guarantee and will afford them adequate protection in their development within the limits of the powers which the law confers upon it."—*Review of the River Plate.*

D

Social Event.

A successful staff party was held recently at the Garrison Lane works of Simplex Conduits, Ltd., Birmingham. The proceedings opened with a collation, during which many toasts were drunk heartily, and Mr. McLoughlin presented prizes in connection with the ping-pong tournament. Mr. Spiller complimented the Welfare Committee on its excellent handling of the arrangements, and Mr. Boulton, in replying, tendered the sincere thanks of the staff to the management. The gathering then adjourned for dancing.

Street Lighting at Southend.

The accompanying illustration shows one of the main thoroughfares of Southend-on-Sea illuminated by G.E.C.

" Wembley " Street Lanterns at Southend.

" Wembley " lanterns. This is a twin overhead suspension installation, and, of course, " Osram " lamps are used.

New Belgian Company.

Omnium d'Affaires Electriques is the name of a company recently formed in Liége (15, Boulevard d'Avroy), with a capital of ten million francs. Its objects are to acquire interests in electrical enterprises and to plan and carry out installations relating thereto.

New German Company.

Under the title of the Suddeutsche Apparatefabrik Gesellschaft a company has recently been formed in Nuremburg with a capital of £50,000 to take over the telephone and radio apparatus manufacturing section of the business of the Suddeutsche Telefon Apparate, Kabel und Drahtwerke Gesellschaft, of that city.

" English Electric " Activities in 1929.

The ENGLISH ELECTRIC CO., LTD., has sent us a lengthy account of its work during the past year. Increased business was secured in plant and machinery and over 300,000 h.p. of medium and large industrial machines was ordered from the company. Notable among these were alternators for coupling to water turbines, machines with power-factor improving devices, flywheel-type alternators to be driven by low-speed engines, automatic rotary-convertor sub-station units, motor-convertors, frequency changers (including further orders from Canada), generators and motor-generator sets for the new B.B.C. station at Brookman's Park, &c. The switchgear shop extensions have been fully occupied during the year; two important contracts were received from the Central Electricity Board (one jointly with the Croydon Corporation) of a total value of £140,000. The company also received an order for a large 33-kV outdoor sub-station at Barford in connection with the national " Grid " system. A comprehensive power station contract in Greece was completed during the year; it comprised three 15,000-kW turbo-alternators, with transformers and coal-handling equipment. In association with Messrs. Ganz, of Budapest, the company is supplying the main turbines, condensing plant, 110-kV switchgear, transmission lines and sub-station equipment in connection with the Budapest electricity scheme and State Railway electrification.

Large orders for industrial motors have been received from home and overseas customers, including South America and India. Mention is made of the development of the company's " Kosfi " and " Closvent " motors and the range of a.c. control gear has been extended. During 1929 there was considerable activity in the company's hydro-electric branch. An order was received from New Zealand for two 16,666-kVA alternators for the Waitaki power station. These are similar machines to those supplied for the Perak River hydro-electric scheme. Two 17,000/22,000-h.p. vertical reaction water turbines were ordered from the company for the Grampian scheme. Contracts were also placed for a 6,000-h.p. set for the Kurra Falls station of the Nigerian Electricity Corporation; for two 7,250-h.p. horizontal-shaft reaction turbines for the Shannon River scheme, Tasmania (this also includes switchgear); and for two 1,800-kVA vertical-shaft alternators for the Grey Electric Power Board, New Zealand. Good progress has been made with the Lochaber and Kinlochleven contracts and those for Lake Coleridge (N.Z.) and the Perak River scheme. The traction department received orders for 50 car bodies and 100 equipments from the L.C.C. Tramways, and contracts for trolley 'buses were placed by the Bradford, Darlington, Maidstone, and Nottingham Corporations. The South Indian Railway Co. ordered seventeen train units, each consisting of a 480-h.p. motor coach and two trailing coaches, and during the year 23 English Electric motor coach equipments were put into service in Japan. The transformer contracts secured included one for about 140,000 kVA of 33-kV transformers for the Central Electricity Board, and the equipment of Messrs. Siemens Bros.' high-voltage laboratory at Woolwich.

New Indian Companies.

Among the companies recently formed in India are the Bogra Electric Supply Corporation, Saraf Buildings, Thana Road, Bogra Town, Bengal, capital 300,000 rupees; the Mirzapur Electric Supply Co., 14, Old Court House Street, Calcutta, 800,000 rupees; and the Giridih Electric Supply Corporation, Hazaubagh, Bihar and Orissa, 700,000 rupees.

Recent Contracts.

Harcourt fittings made by METRO-VICK SUPPLIES at its Birmingham factory have been installed at Chiltern Court, the large block of residential flats recently built over Baker Street station. The whole of the fittings in all the public rooms, entrance hall, corridors, restaurant, &c., form part of this contract. The selection of the fittings for the flats themselves, is, of course, left to the incoming tenant. Harcourt fittings have recently been supplied for the Plymouth Hippodrome, Bonington Theatre, Nottingham, the Stock Exchange Restaurant, Manchester, Sligo Cathedral, Ireland, and the Bristol Art Gallery.

Messrs. BOVING & Co., LTD., have received an order for two 20,400-b.h.p. Francis turbines from Electra de Viesgo, Santander, Spain. These machines are of the vertical spiral casing type, are to work under a head varying between 25 metres and 72.5 metres, and run at a speed of 250 r.p.m. Owing to the wide variation in head, each turbine will be supplied with two runners, one for the range from 25 metres to 55 metres, and one for the range from 45 to 72.5 metres, and the turbines will be so constructed that these runners will be quickly interchangeable. By this means improved efficiencies over the whole range of heads are obtained with a maximum of 91.5 per cent. in the case of both runners.

THE HART ACCUMULATOR CO., LTD., is supplying the batteries for the ignition and fan systems of the " world's largest lifeboat " built to the order of the Royal National Lifeboat Institution.

The RELAY AUTOMATIC TELEPHONE CO., LTD., has received an order from the Carlton Hotel, London, for the equipment of the building throughout with a private " Relay " automatic telephone system.

Trade Announcements.

The ENGINEERING & LIGHTING EQUIPMENT CO., LTD., Sphere Works, St. Albans, Herts, has purchased the assets of the Pinnacle Switchgear & Fuse Co., Weybridge, as from November 14th, 1929. The business will be run in conjunction with the St. Albans works, and in future orders and inquiries will be dealt with both from Weybridge and St. Albans.

The MARCONIPHONE CO., LTD., has decided that in future it will not supply any of its products to Co-operative Societies, and is addressing a communication to its wholesalers and retailers accordingly.

The CURTIS MANUFACTURING CO., LTD., informs us that it is no longer represented by Mr. T. J. Boorne at Manchester. All inquiries and orders should be sent direct to the works at 32, Spring Street, Paddington, W.2, or to Conduitt Place, Paddington.

The D.P. BATTERY CO., LTD., has moved its service depôt from Orchard Street, S.W.1, to larger premises at 107a, Pimlico Road, S.W.1. The charging of electric vehicles can now be undertaken.

For Sale.

The Torquay Hotel Co. has for disposal a complete private generating plant and battery. Stockport Corporation Electricity Department invites offers for the purchase of two Babcock & Wilcox water-tube boilers, complete with super-heaters and chain-grate stokers. Edinburgh Corporation has for sale one B.T.H. 5,000 kW, 6,000 V, 3-phase turbo-alternator, complete with auxiliaries. (See our advertisement pages to-day.)

Australian Electrical Imports.

The Sydney correspondent of the *Daily Telegraph* says that the revised figures relating to the imports of British goods into Australia during the year ended June last, show that the British share of the total trade is under 40 per cent. The total is £57,000,000, the lowest for seven years. The decline is entirely due to smaller imports of manufactured goods; imports of electrical machinery were reduced by over £1,000,000.

New Italian Companies.

Among the concerns recently formed in Italy are the Società Elettro-Irrigua Siciliana, Milan, capital, 1,500,000 lire, for the supply of electric power for lighting, power, and irrigation purposes in Sicily; the Società Azienda Elettrofonica Romagnola, Milan, to establish telephone lines; the Società Impresa Elettrica S. Savagnone, Palermo; the Società Romana Impianti Elettrici e Telefonici, Rome; and the Società Nazionale di Elettricita, Rome.

New German Meter Company.

The formation has taken place in Berlin of the Aronwerke Elektriciäts, A.G., with a share capital of 8,000,000 marks. As from January 1st, 1929, the company has taken over a number of undertakings which are concerned with the construction of electricity meters and clocks. About one-half of the share capital is said to be held by Herr Manfred Aron.

Lamp Manufacture Control in Spain.

It is reported from Madrid that the Spanish Government intends to place the glow lamp industry under State control, and that the establishment of new glow lamp factories will provisionally not be sanctioned.

Unemployment in Germany.

The Berlin correspondent of *The Times* states that the German unemployment figures, which sank to about 860,000 in midsummer, are showing the usual seasonal increase and had risen to approximately 1,600,000 in the middle of December, as against 1,415,000 twelve months before.

Hardening Steel Golf Shafts.

In view of the recent introduction into this country of golf clubs with steel shafts, it may be of interest to many readers to know that the leading American firm of steel golf shaft makers has for some time past been hardening these shafts in electric furnaces designed by WILD-BARFIELD ELECTRIC FURNACES, LTD., and since the "legislation" of the shafts in Great Britain, the company has received orders for similar equipments for this country. These furnaces are of a very special design, and, in addition to a new form of automatic control of temperature, &c., there is also an automatic quenching device.

The Industrial Situation.

At yesterday's monthly informal luncheon of the British Engineers' Association, Mr. D. A. Bremner, the Director of the Association, was to deliver an address on "The Realities of the Industrial Situation."

Bankruptcy Proceedings.

S. PERKINS, wireless dealer, 1, Lodge Lane, Beeston, Leeds.—Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds, released December 13th.

H. SAVORY, electrical engineer, 7a, Hill Street, Shaw, Lancs.—Trustee, Mr. J. D. Turner, Official Receiver, Byrom Street, Manchester, released December 18th.

H. HOLMES, plumber and electrical contractor, 60, Ward's End, Loughborough.—Bankrupt's discharge suspended until December 4th, 1931.

T. BARNETT, electrical contractor, 934, Woodborough Road, Mapperley, Notts.—Last day for proofs for dividend, January 20th. Trustee, Mr. R. B. Rhodes, 18, Low Pavement, Nottingham.

W. T. GARNETT (W. T. Garnett's Cable Co.), Barkerend Mills, Bradford, supplemental dividend of 4¾d. in the £, payable January 11th, at the Official Receiver's Office, 12, Duke Street, Bradford.

Company Liquidations.

BUILTH WELLS ELECTRIC SUPPLY CO., LTD.—Winding up voluntarily. Liquidator, Mr. H. Ashton, Victoria Hall, Llandrindod Wells.

RADIAX, LTD.—A meeting of members is called for January 27th at 46-47, London Wall, E.C., to hear an account of the winding up from the Liquidator, Mr. F. H. Cooper Christmas.

FELLOWS MANUFACTURING CO., LTD.—First meetings of creditors and contributories were held on January 9th at Carey Street, W.C.

IDEAL WIRELESS CO., LTD.—First meetings of creditors and contributories were held on January 9th at Carey Street, W.C.

TALGARTH ELECTRIC SUPPLY CO., LTD.—Winding up voluntarily. Liquidator, Mr. H. Ashton, Victoria Hall, Llandrindrod Wells.

ELECTRICITY (HULL), LTD.—Particulars of claims by January 20th to the Liquidator, Mr. R. Verity, 135, High Street, Hull.

KIDDERMINSTER & STOURBRIDGE ELECTRIC TRAMWAY CO.—A meeting of members is called for February 5th at 88, Kingsway, W.C., to hear an account of the winding up from the Liquidators, Messrs. H. W. Treverson and C. D. Borer.

Catalogues for New Zealand.

The Department of Overseas Trade says that the Trade Commissioner in New Zealand, Mr. L. A. Paish, who has recently arrived at Wellington, is much impressed with the constant reference which is being made by New Zealand firms to the catalogues of British manufacturers in his office, and many instances have arisen where connections with British firms have been opened up by this means. It is frequently the case that inquirers who wish to be placed in touch with British manufacturers of various goods first of all wish to have a glance through a small range of catalogues but are unable to see them, owing to the absence of suitable up-to-date catalogues in the office. The Trade Commissioner asks for catalogues relating to a number of lines, among them being domestic electrical refrigerating plant, dry battery hand torches, electric clothes-washing and dish-washing machines, and complete radio receiving sets. The catalogues should be forwarded to:—H.M. Trade Commissioner, P.O. Box 369, Wellington. If the firms are not represented in New Zealand the names of any local firms where the goods may be inspected should be given.

New Australian Companies.

Among the companies recently registered in Australia are the following electrical concerns:—Windsor Electrical Co., Ltd., Brisbane, Queensland, capital £10,000, to carry on the business of importers and manufacturers of, and dealers in, electric stoves and all other classes of electrical machinery and appliances; Electrical Installations (Sydney), Ltd., Sydney, N.S.W., capital, £1,000, to carry on the business of electrical and general engineers and contractors; and the Hillston Electric Supply Co., Ltd., Hillston, N.S.W., capital £8,000, to carry on the business of an electric light and power company.

Engineering Advertisers' Meeting.

A meeting of the Lancashire Engineering Section of the Incorporated Society of British Advertisers is to be held on January 17th, at the Victoria Hotel, Deansgate, Manchester. Mr. J. Taffs (English Electric Co., Ltd.) will preside, and Mr. A. H. Angus (general secretary) will deliver an address on "Unnecessary Advertising Snags."

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Jan. 7th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	....
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3½d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£164	£4 dec.
	Grade II... ... ... ,, ,,	£115	£3 dec.
	Grade III ... ... ,,	£65	£1 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	10½d.	...
c	,, Tubes (solid drawn) ... ,,	1/0½ to 1/1	...
c	,, Wire, basis ... ... ,,	10½d.	...
c	Copper Tubes (solid drawn) ... ,,	1/8	...
g	,, Bars (best selected) ... per ton	£110	...
g	,, Sheet ... ... ,,	£110	...
g	,, Rod ... ... ,,	£110	...
d	,, (Electrolytic) Bars ... ,,	£83 15s.	5/- dec.
d	,, Sheets ... ,,	£143 10s.	...
d	,, Wire Rods ... ,,	£89 15s.	5/- dec.
d	,, H.C. Wire per lb.	11¼d.	¼d. dec.
f	Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/1	1d. dec.
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	6¾d.	...
i	Iron, Pig (Cleveland No. 3.) ... per ton	72/6	...
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£23	5/- dec.
g	Mercury ... ... per bot.	£23 to £23 5s.	...
e	Mica (in original cases) small ... per lb.	6d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/3½	...
p	,, ,, wire... ... ... ,,	1/6	...
e	Platinum ... ... per oz.	£18	10/- dec.
d	Silicium Bronze Wire ... ... per lb.	1/3	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£177 to £178	£3 10/- to £3 15/- dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on the lead position on January 4th, Messrs. James Forster & Co. said that the market has been subject to holiday influences and little business was transacted during the past fortnight. No new feature has arisen except a sudden advance of 5s. per ton in the December position on the last day of the year, probably for "window-dressing" purposes. The immediate outlook for this year is not promising. Demand shows no signs of revival, and remains of a hand-to-mouth character. Supplies generally are ample for present requirements. "Had the market been free from control, we should certainly have expected lower prices, but, as it is, there is nothing in the position to justify a higher level."

New Argentine Companies.

The *Review of the River Plate* reports the formation of the following companies in Argentina:—The Corporacion Sudamericana de Telefonos y Telegrafos, Buenos Aires, capital $4,000,000 (paper), to finance, acquire, construct and exploit in Argentina and elsewhere telephone and telegraph or associated companies; the Compania de Electricidad del Este Argentina, Buenos Aires, capital $4,000,000 (paper), to acquire, buy, sell, construct and exploit power stations and systems for the distribution of electricity, gas, water or steam, &c., and the Compania Central Argentina de Electricidad, Buenos Aires, capital $10,000,000 (paper), to deal in public utility services, electric light, power, transport, communications, &c.

Lighting and Power Notes.

Accrington.—ELECTRICITY CHARGES.—The Corporation Electricity Committee has asked the Housing Committee to put into operation an arrangement by which a charge of 1s. per week for electricity will be made and collected with the rent, any necessary adjustment to be made at the end of each quarter.

Bath.—NEW PLANT.—The Electricity Committee recommends the City Council to apply for sanction to a loan of £24,960 for the installation of a 7,000-kW turbo-alternator.

Birkenhead.—PRICE REDUCTION.—The Corporation Electricity Committee proposes to reduce the flat rate charge through ordinary meters from 4½d. to 4¼d. per kWh, and from 5d. to 4¾d. per kWh through prepayment meters. For large consumers the first 3,000 kWh per quarter will be 4¼d. per kWh, and the remainder 3¾d. instead of 4d. The rate for cooking and heating purposes will be reduced from 2d. less 5 per cent., to 2d. less 10 per cent.

Burnley.—UNEMPLOYMENT SCHEME.—In response to the letter from the Electricity Commissioners, suggesting the acceleration of electricity schemes to relieve unemployment, the electrical engineer has reported that work can be put in hand in certain parts for the changing of the system of supply from d.c. to a.c. at an estimated cost of £50,000. A committee is to consider and report upon the matter.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Southern Canada Power Company has applied to the Provincial Government of Quebec for authority to construct dams and plant near Spicer Rapids, on the St. François River, for the development of 50,000 h.p. The cost of the work is estimated at about $6,000,000.

Clacton.—UNEMPLOYMENT SCHEME.—At a recent meeting of the Urban District Council the electrical engineer submitted a report of the Electricity Committee embodying a scheme for the relief of unemployment. The scheme, which was estimated at cost £10,000, included the change-over of the system of supply at Great Clacton from d.c. to a.c. within the next two years. The Council approved the report.

Colchester.—LOAN.—The Corporation Electricity Committee is to make application for sanction to the borrowing of £7,107, the estimated cost of a proposed transmission line from Hythe generating station to Ardleigh.

Continental.—FRANCE.—The Société des Forces Motrices de la Vallée d'Aspe of Paris has recently secured a concession to establish a hydro-electric station to utilise the power of the River Arnousse, near Borce-et-Urdos, in the Lower Pyrenees.

GERMANY.—In order to meet the increasing demand for power supply in the German capital, the Berlin Municipal Electricity Co. is erecting a large new power station in Western Germany between Siemensstadt and Spandau. The plant, which is to be ready for operation by the autumn of 1931, will comprise six 34,000-kW steam turbo-generators and two house sets each of 12,000-kW capacity.

Crewe.—MAINS EXTENSION SCHEME.—With a view to assisting in dealing with unemployment, the Electricity Committee has instructed the engineer to prepare a comprehensive scheme for the laying of a private cable in every street in the town not already provided for, and, in cases where it is desirable to lay cables for linking up existing mains, to proceed with this work. The Town Council has approved the Committee's decision.

Derby.—LOAN.—The Town Council has applied for sanction to a loan of £77,398 for electricity purposes, and has withdrawn a previous application for a loan of £50,000 for mains, transformers, and motors.

ELECTRICITY SCHEMES.—The Corporation Electricity Committee has decided to proceed with a scheme costing £21,000 for the change-over of the supply from d.c. to a.c. in various districts. Mains are also to be provided in certain streets not already served, at a cost of £3,100. Material required in connection with these works is to be supplied by local firms. An application for assistance has been made to the Unemployment Grants Committee.

East Cornwall.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the East Cornwall Electricity Supply Co., Ltd., to supply electricity in the borough of Saltash, the urban district of Torpoint, and the rural district of St. Germans.

Eccles.—YEAR'S WORKING.—We have received from Mr. H. W. Angus, borough electrical engineer, a copy of his report together with a statement of accounts of the electricity undertaking for the year ended March 31st last. The total revenue amounted to £46,964, as compared with £47,130 in the preceding year, while the working expenses were £33,019, as against £32,345. The gross profit totalled £13,944 (£14,785), to which were added £2,787 balance brought forward from the previous year, £171 unemployment grant and £213 bank interest, making a total of £17,115 available. After providing for interest and sinking fund charges there was a net surplus of £8,298, as compared with £4,956 in 1927-28. The capital expended during the year amounted to £20,844, bringing the total now spent on the undertaking to £173,869. The electrical energy sold increased from 7,011,374 to 7,798,787 kWh and the maximum demand from 3,316 to 3,488 kW. The average price obtained per kWh fell from 1.57d. to 1.40d. During the year the supply of electricity in bulk by the Lancashire Electric Power Co. to meet the total requirements of the undertaking was inaugurated and the Cawdor Street generating station was permanently closed down on June 30th, 1928.

Guildford.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee reports that application has been made by Mr. O. Spillern for a supply to a new estate in Abinger Hammer. This estate is outside the area of supply, and comes under that of Edmundsons' Electricity Corporation, Ltd. The engineer has been in communication with the company regarding the possibility of giving a bulk supply and has received a reply to the effect that the time is not yet opportune to consider the matter.

Heston and Isleworth.—ELECTRICITY SUPPLY FAILURE.—A failure of the electricity supply, lasting about half an hour, occurred on Monday last at about 6.20 p.m.

Japan.—HYDRO-ELECTRIC DEVELOPMENTS.—The Toyama Prefectural Electric Bureau has decided to erect a hydro-electric plant costing 4,500,000 yen. The station, which will be called Omi power station, will have an output of 15,000 kW, and is expected to be completed by the summer of 1932.

The Azuma-gawa Power Company, which expects to complete its Otsu power station in April next, has decided to develop 18,000 kW and 7,000 kW in two places on the same river or on the Azuma-gawa. The work will be completed by the end of 1932, and it is arranged that the whole of the electrical energy generated shall be sold to the Tokyo Electric Light Company.

Leeds.—NEW PLANT.—The Corporation has voted £20,000 for additional switchgear at the Kirkstall generating station.

Liverpool.—ELECTRICITY SUPPLY EXTENSIONS.—The Corporation Tramways and Electric Power and Lighting Committee is to spend £1,124 on h.p. mains extensions in the Blundellsands district, £2,264 on l.p. mains, and £2,000 on substation equipment.

London.—BATTERSEA.—The Borough Council Electricity Committee has obtained sanction to the borrowing of £78,000 for mains and services.

Monmouth.—PROPOSED SALE OF UNDERTAKING.—The Electricity Committee of Monmouth Corporation, as a result of advice received from Mr. A. W. Blake, its consulting engineer, has unanimously recommended the Council to transfer the Provisional Order and the undertaking to the General Electric Co., Ltd., on terms provisionally agreed. The most important of these are: (1) purchase price, £16,000, and the Corporation to discharge sum still due on loans, *i.e.*, £3,900; (2) Corporation to retain reserve fund and working capital; (3) tariff not to exceed present prices per kWh (except in national emergency) of 6½d. for lighting and 3d. for power. The company proposes to charge 20 per cent. of the ratable value and 1d. per kWh; (4) company to light and supply fittings for present public lamp standards at the present charge of £250 per annum, the minimum candle-power of each lamp to be 100; (5) extensions required by Corporation to be limited to roads within 30 yards of a distributing main at *pro rata* charges, the Corporation supplying standards and lanterns; (6) the company to take over the present staff. The whole of the share capital of the company will be held by the General Electric Co., Ltd. The company desires to take over the undertaking on March 31st next or any earlier date with a view to reorganising it before next winter.

Northern Ireland.—BELFAST.—The Corporation has announced that it is prepared to supply electricity throughout the Belfast rural district at 7d. per kWh for lighting and 3d. per kWh for power, provided that a guarantee is received of a revenue of 20 per cent. per annum of the capital required to provide the supply from the nearest point of the mains.

Plymouth.—MAINS EXTENSIONS.—The Corporation Electricity Committee has approved cable extensions in 18 streets and roads in Plymouth and Devonport at a total estimated cost of £2,881.

Ripon.—ELECTRICITY SUPPLY EXTENSIONS.—The City Council, which last August inaugurated an electricity service for the main parts of the city, is now applying for sanction to the borrowing of £3,000 to extend the service to Bishop Monkton and some outlying parts of the city. The Bishop Monkton service was in the original proposal, but was held up by some opposition to overhead lines in the village streets. The city area extended service will be to Palace Road, Spring Bank, and a further extension along the Harrogate Road. The Corporation Electricity Committee has also decided to lay mains in Harrogate Road at a cost of £1,523.

Scunthorpe and Frodingham.—ASSISTED WIRING SCHEME.—The Urban District Council has applied for a loan of £1,568 for the assisted wiring of an additional 200 houses. Under the scheme 340 houses have been wired, leaving 60 to complete the number sanctioned by the Commissioners.

Stratford-on-Avon.—NEW ELECTRICITY TARIFF.—The Town Council has arranged with the Stratford-on-Avon Electricity Co., Ltd., for a new scale of charges, and the Council waives its option to take over the undertaking in 1931. The scale is as follows:—Residential tariff: a fixed charge per room plus 1d. per kWh consumed. Alternative rates, heating and cooking, flat rate of 1½d. per kWh. Business premises: lighting, first 90 kWh per quarter, 8d. per kWh; beyond, 2d. per kWh. Power, 2d. per kWh for the first 10,000 kWh per quarter, beyond, 1½d. per kWh. Under the agreement the price under the lighting flat rate is reduced to 6½d. per kWh from the 1st of this month, and to 6d. from July 1st next, and the charge for prepayment meter supplies is lowered to 7½d. per kWh from the 1st of this month, and to 7d. from July 1st next, with a rebate of 1d. per kWh after the first 100 kWh per annum.

Tunbridge Wells.—LOANS.—The Town Council has applied for sanction to loans of £13,201 for mains extensions, and £1,514 for sub-station pillars and equipment.

United States.—POWER PLANT EXTENSIONS.—According to *Power* the capacity of the Marysville steam plant of the Detroit Edison Co. will soon be increased to 160,000 kW by the addition of a 50,000-kW turbo-generator. During 1931 an addition to the boiler room structure is to be built to accommodate two more boilers, which will make ten boilers in all for a load of 160,000 kW.

POWER INDUSTRY EXPANSION.—The ninth annual report of the Federal Power Commission published recently states that applications for the generation of electricity filed with the Commission up to the close of the fiscal year totalled 1,002; licences were issued in 373 cases which authorise in the aggregate an installation of 5,744,239 h.p., while a total capacity of 2,652,066 h.p. is generated from plants already completed. The generation of electrical energy by municipal and privately owned plants serving public utility purposes reached a total of 88,000,000,000 kWh in 1928, which represents an increase of 126 per cent. over the annual production of ten years ago. Preliminary figures indicate that the increase of production in 1929 will exceed that of 1928, although the proportion generated by water power will be reduced considerably. This was due largely to the prolonged drought that affected the northern section of the United States, which required the substitution of steam-generated energy to meet the deficiency of water power plants. The report adds that he country's electrical energy requirements generated from water power have fluctuated betwen 34 and 40 per cent. of the total.

ELECTRICITY SUPPLY PROGRESS.—The production of electricity for public use during 1929 is now estimated by the National Electric Light Association at 97 billion kWh. During the last seven years the industry added 13¼ million kW to its generating capacity; constructed nearly 50,000 miles of transmission lines above 22,000 volts; doubled the output of energy, and increased its customers by more than 11 millions. At the close of 1929 the total generating capacity was nearly 40 million h.p.

Wakefield.—RATABLE VALUE TARIFF.—The Corporation Electricity Committee has fixed the following graded scale of percentage charge for the ratable value tariff for electricity supplied:—Up to £20 ratable value, 17½ per cent.; from £20 to £60, 15 per cent.; above £60, 12½ per cent.

SHOP-WINDOW LIGHTING.—The Committee has also decided to charge a flat rate of 2d. per kWh for shop-window lighting and advertising displays, with a minimum of 21s. per 100-watt lamp installed per annum.

West Lancashire.—LOANS SANCTIONED.—The Maghull and Lydiate Rural District Council Electricity Committee has received sanction to loans of £1,000 for house wiring on the instalment plan and £5,015 for the purchase of domestic apparatus for hire.

Wimbledon.—PRICE REDUCTIONS.—The Corporation Electricity Committee recommends that the reduction in the running charge to industrial power consumers under special agreement from ½d. per kWh to 0.4d. per unit authorised for the September quarter be continued, subject to the operation of the coal clause; that the reduction in the domestic power rate from ¾d. to ½d. per kWh authorised for the September quarter be adopted for future June and September quarters, and that the charge for electricity for public lighting be reduced from 1½d. to 1¼d. per kWh.

York.—CHANGE-OVER SCHEME.—The Corporation Electricity Committee recommends the adoption of a scheme for changing portions of the city's electricity supply system from d.c. to a.c. in order to relieve the demand on the d.c. mains. The Committee also recommends that application be made for sanction to a loan of £36,395 in connection with the scheme.

Tramway and Railway Notes.

Argentina.—BUENOS AIRES.—According to the *Review of the River Plate*, the special technical committee appointed by the Municipal Intendent to study and report upon the proposals presented by a Spanish concern and by a British consortium, has completed its task with regard to the former—the Compañia Anonima de Proyectos y Construcciones de Madrid. The committee formulated a draft Concession, and informed the company concerned of its text. One of the main stipulations is that the tariffs for passengers on direct journeys must in no case exceed ten cents. With respect to the company's proposal to modify the Retiro-Constitucion route by bringing it along Avenida Leandro N. Alem, the committee says that it will be preferable to continue the route along Calles Bernardo de Irigoyen and Carlos Pellegrini as far as Juncal, and thence on to Retiro.

Bradford.—RAILLESS CARS.—The Corporation Finance (Estimates) Sub-Committee has approved the expenditure of £15,580 on the equipment of the Idle tram route for the change-over to the railless-car system (including the cost of six new trolley cars), and for the extension of the railless-car service from the existing tramway terminus at Idle to the junction of Albion Road and Leeds Road.

Burton.—TRAMWAY ABANDONMENT.—The Corporation's electric tramway system, which has been in operation for 26 years, was abandoned on December 31st in favour of single-decker 'buses of the "one-man pay-as-you-enter" type.

Continental.—FRANCE.—At a recent meeting of a French electrical equipment company presided over by M. Francois Marsal, a former Minister of Finance, who is attached to the Banque de l'Union Parisienne, it was announced that the company had become proprietor of a number of patents for French electric locomotives which were expected to influence this branch of transport. These are said to be cheap to build and run, and to induce further economies in that the wear and tear of the permanent way is reduced.

One of these locomotives has been tried on the Swiss Federal Railways for the last eight months, and one of the big French railway companies has given a trial order for a vehicle to carry sixty passengers and not to exceed 24½ tons in weight. According to the *Financial Times*, the idea seems to be that, instead of running long trains as at present, the railway will be able to run short trains carrying 60 to 100 passengers within two or three minutes of each other.

As a result of the fusion of the Nord-Sud and Metropolitan tube railways which came into effect on January 1st, the underground railway system of Paris is now under unified control.

ITALY.—A scheme for the complete reorganisation of the city's transport communications came into operation in Rome on January 1st. All the tramcars have been removed from the centre of the city and now run on circular routes round its circumference. 'Buses are used to link up the tramway services and to carry passengers to central points within the city.

GERMANY.—Work is in hand on the construction of an electrically-operated suspended cable railway up the Nebelhorn, near Munich. The valley station is situated in Oberstdorf, the tourist centre of Allgau, which lies 2,765 ft. above sea level. The cableway, rising to a height of 7,298 ft., will be approximately 3 miles in length, and will be divided into two sections. The first will extend from the valley station at Oberstdorf to the Seealpe at a height of about 4,920 ft.

India.—DELHI.—The Delhi Electric Supply & Traction Co. has applied to the Municipal Committee for sanction to run railless cars from Hauz Qazi to Ajmeri and beyond. An electric tram service was operated on this route several years ago by this company but was discontinued. The company now considers, however, that with the construction of the New City a service on this route is essential.

BOMBAY.—The Bombay Electric Supply and Tramways Co. is to extend the tramway along Sydenham Road to the junction of Palton-Hranby roads.

London.—TRAMCAR "STOP" SIGNALS.—Experiments are being carried out by the London United Tramways on the Wimbledon-Hampton Court route with an illuminated "Caution" sign for the assistance and protection of passengers boarding and alighting from the tramcars.

FASTER ESCALATORS.—Experiments are being carried out at Tottenham Court Road station with an escalator travelling at a speed of 150 ft. per minute, instead of the ordinary rate of 90 ft. per minute. Should these experiments prove a success, the installation of faster escalators at certain stations will be contemplated.

Middlesex. — TRAMWAY EXTENSIONS AUTHORISED. — The Minister of Transport has made an Order authorising the Middlesex County Council to contruct light railways in the urban district of Tottenham and in the Borough of Walthamstow.

Oswaldtwistle.—TRAMWAY ABANDONMENT.—The Council has agreed to the conditions of Accrington Corporation regarding the abandonment of the Oswaldtwistle section of the tramways, shortly to be effected through replacement by 'buses.

South Africa.—DURBAN.—According to the *Times Trade and Engineering Supplement* the construction of an electric railway along the Victoria Embankment, Durban (formerly known as the Esplanade), to relieve congestion in Durban harbour, was one of the undertakings given by the Minister of Railways and Harbours after exhaustively discussing the whole matter with representatives of public bodies in Durban. Apart from two dissentients, the conference was unanimous that the Point and Congella should be linked up by a railway line running along the Victoria Embankment. The Railway Administration undertook to construct a line, after consultation with the Town Council of Durban, in a manner to interfere as little as possible with the amenities of the foreshore, and has undertaken to operate this line by means of electric or other smokeless engines, subject to the exigencies of the service. The Administration has agreed, bearing in mind the urgent necessity for providing facilities for relieving the congestion at the Point, to call for tenders, in anticipation of funds being voted by Parliament, for an 80-ton heavy lift crane, a 25-ton floating crane, and such additional electric cranage as will be necessary to deal with the traffic.

The Southern Railway.—THE WIMBLEDON-SUTTON LINE.—The Southern Railway Company's new electric line between Wimbledon and Sutton was opened for traffic on Sunday last. The line is 5¼ miles long and has six new stations: Wimbledon Chase, South Merton, Morden South, St. Helier, Sutton Common and Sutton West. A 20-minute service during business hours and a 30-minute service at other times, will operate between Holborn Viaduct and West Croydon, connecting at Sutton with services to and from Victoria, and at Wimbledon with services to and from Waterloo.

Train Control.—GOVERNMENT INQUIRY.—Important developments in the direction of improving the safety of railway travel will, it is believed, follow the completion of an exhaustive Government inquiry into methods of automatic train control. The *Daily Dispatch* understands that the Ministry of Transport Committee which has been investigating methods of train control has nearly completed its inquiry, and that its report may be expected shortly.

Telegraph and Telephone Notes.

Atlantic Cables.—REPAIR WORK.—Reports from the Western Union, Commercial, and French telegraph cable companies indicate that 600 miles of new cable, costing well over $500,000 £100,000), will be necessary to mend the gaps caused by the earthquake off Breton Island on November 18th. Seven cable ships have been at work in the area since the end of November. It appears that the earthquake caused extensive changes in the contours of the ocean bed, shifting many cables far from their original positions and burying others. The Radio Corporation reports that its transatlantic business has increased by half since the earthquake, says *The Times*.

The London manager of the Commercial Cable Co. received news on January 1st that the first of its three cables broken in the upheaval had been reconnected after arduous labour. Seven times the cable was dragged up from the sea bed and dropped again before it was possible to reconnect the broken ends by inserting 40 miles of fresh cable in the gap.

Imperial and International Communications, Limited, announces that cable communication to North America has been restored on the Imperial cable between Porthcurnow, Cornwall, and Halifax. Both the Imperial cables were interrupted, and the C.S. *Cambria* was dispatched from the West Indies to restore communication, but the ship being normally on a tropical station the severe weather and icy climatic conditions handicapped the repair work considerably. Eventually it was found necessary to fit the ship throughout with steam heating, to repatriate the West Indian crew, among whom were several casualties from frost bite, and engage a local crew more accustomed to the severe cold. Meanwhile it was necessary to dispatch cable from England to Halifax as expeditiously as possible, and by making special arrangements the Cunarder S.S. *Ausonia* left Southampton on November 29th with over 150 miles of cable on board after loading work which proceeded uninterruptedly for 48 hours. The cable between Halifax and Harbour Grace, Newfoundland, was interrupted in two places about 386 and 420 miles, respectively, from Halifax, the breaks were repaired on January 2nd, and communication restored. In spite of the cable interruptions, traffic for North America was handled by the company without abnormal delay, messages being transmitted either by wireless to Montreal or New York, or by numerous alternative routes available by the cable system, telegrams being sent *via* Australia and the Pacific, South America and Barbadoes and Bermuda. The resources of the company were thus tested to the full by the emergency; in addition, the company was able to render valuable assistance to foreign companies whose cables were interrupted by the earthquake.

Italy.—TELEPHONE EXTENSIONS.—In furtherance of the Government's scheme for developing an interurban telephone system, a new cable has just been completed between Rome and Florence, 178¾ miles long, passing through Viterbo, Abbadia, San Salvatore and Siena; it has multi-conductors, and is able to establish 214 direct telephone communications. The installation is equipped with loading (Pupin) coils at intervals of about 1.8 km., and vacuum-tube amplifiers are placed at an average distance of about 75 kilometres apart. From Naples to the Alps the system will have 22 amplifying stations, including those already in operation. It has just been decided to proceed forthwith with the construction of the southern system section, which will link the whole of the peninsula and Sicily. Three stations will be built for marine telephone cables to Sardinia and Zara. The central and northern sections will be completed within about two years, and the southern within five years.—*Reuter's Trade Service* (Rome).

Java.—RADIO STATION FIRE.—It is reported that the Dutch wireless station on Long Island, in the Java Sea, has been destroyed by fire.

Photo-telegraphy.—ANGLO-GERMAN SERVICE.—The British Postmaster-General announced last week that a service was inaugurated on January 7th that enables practically any kind of picture, drawing, photograph, or writing to be telegraphed in facsimile direct between London and Berlin. The normal working hours of the service are 7 a.m. to 11 p.m. The charge is at the rate of 2d. per square centimetre, with a minimum of £1 covering ninety-six square centimetre, which is practically equivalent to 1s. 4d. per square inch, with a minimum of £1 for approximately fifteen square inches. The pictures must be rectangular and their dimensions must not exceed twenty-five centimetres by eighteen centimetres (approximately ten by seven inches), but a larger picture can be sent if the sender divides it into rectangular pieces not exceeding the maximum dimensions. Acceptance of picture telegrams is limited at the outset to six offices in London, and in the provinces to the head offices in Birmingham, Edinburgh, Glasgow, Liverpool, Manchester, and Newcastle, whence they are forwarded by post to the central telegraph office in London.

South America.—TELEPHONE EXPANSION.—So rapid has been the growth of telephone traffic in the River Plate district that it has been decided to install seven more circuits between Montevideo and Buenos Aires, and three new circuits from Buenos Aires to Santiago (Chile). Construction work has commenced; from Buenos Aires to Mendoza the circuits will be of the high-frequency carrier-current type, permitting the transmission of several conversations at different frequencies over the same physical circuit simultaneously without interference. At Mendoza the transmission will revert to ordinary telephone frequency, thence, with the exception of 16 kilometres traversing the summit of the Cordillera, there will be physical, or phantom, circuits over copper wires of an unusually heavy type. Four of the latter are being strung through the high Andes on poles already erected; at other parts of the line new poles are being set between the existing ones to afford the lines greater resistance against storm-winds and the weight of snow. Across El Cumbre (the summit) the 16 kilometres of line will be in an underground cable of special design. Loading coils will be installed at frequent intervals; at every 300 yards there will be an underground testing-box. The cable will extend from the repeater station at La Vacas (Argentina) to that in Rio Blanco (Chile). It is intended to erect repeater installations at the main exchange of the Chile Telephone Company, Santiago, and others will be installed in the Cuyo automatic-exchange building at Buenos Aires, where the international circuits and all long-distance lines of the United River Plate Company terminate.—*Reuter's Trade Service* (Montevideo).

A contract has been concluded between the Brazil State Government and the Companhia Telefonica Riagrandense for the extension of underground telephone plant in Rio Grande; for re-laying the Puerto Alegre-Itapuán line; the extension of underground and aerial plant in Puerto Alegre; the installation of a 50-watt radio station at Uruguayán, and the construction of additional conductors on the Bage-Sao Gabriel and Sao Sepe-Sao Gabriel lines.—*Reuter's Trade Service* (Puerto Alegre).

United States.—TELEPHONE TARIFF.—The American Telephone and Telegraph Co. announced a new schedule of toll telephone rates on January 1st, representing an annual saving to the public of more than $5,000,000. Approximatley 45,000,000 calls a year, the majority interstate, will be affected by the reductions. On most station-to-station daytime calls to points approximately 60 to 300 miles distant there is a reduction of 10 cents. The new schedule also reduces the over-

time charge on person-to-person messages of more than ten chargeable minutes. This is the fourth decrease in toll and long-distance rates that the company and its associates in the Bell system have made in less than three and a half years.

Radio Notes.

Australia.—LICENCES.—There was a remarkable increase in October in the number of new wireless listeners' licences issued in Victoria. They numbered 3,986, bringing the total to 144,295, which is higher than ever before. New licences issued in New South Wales during October numbered 1,940. The total number held in each State is as follows:—Victoria, 144,295; New South Wales, 107,489; South Australia, 24,737; Queensland, 23,505; Tasmania, 5,441; Western Australia, 4,353.

Canada.—LICENCES.—During the seven months of the fiscal year ended October, 1929, the number of receiving licences issued was 260,485, says *World-Radio*, compared with 199,548 in the corresponding months of 1928. Ontario issued 129,324 in the seven months; Quebec was next with 45,446; Manitoba had 17,083; Saskatchewan, 19,534; Alberta, 12,316; British Columbia, 23,283; Toronto, 36,033; Montreal, 29,937; Ottawa, 5,941, compared with 7,073 in the twelve months of 1928; Hamilton, 9,363; London, 6,500; Winnipeg, 9,567; Calgary, 2,140; Edmonton 1,115; and Vancoucer, 10,843.

Denmark.—NEW BILL.—The Minister of Public Works has laid a new Broadcasting Bill before Parliament. Its principal provisions are similar to those at present in force, excepting that the Broadcasting Council of 15 members is to be nominated for four years instead of two.

Empire Transmitter.—AERIAL FAILURE.—The aerial of the B.B.C.'s short-wave Empire transmitter at Chelmsford (5 SW) was blown down on December 29th. A new station for this service, probably of the beam type, has been under consideration for some time. Although 5SW started operations two years ago and has regularly transmitted the London programme from 12.30 to 1.30 p.m. and from 7 p.m. until midnight on most week-days, it has never been claimed that it provided a programme service. No part of the licence fees paid by British listeners will be used for the purpose of erecting a station for a service outside Great Britain. The B.B.C. has no fund for the purpose, says the *Daily Chronicle*, so the question of financial support will probably come before the Cabinet at an early date.

Germany.—RECEIPTS.—According to a report lately issued by the German Postal Department, the receipts of the ten broadcasting stations in Germany from radio receiving licences and other sources amounted during 1928 to roundly £1,600,000, while the expenditure during the year totalled £1,440,000. Of the capital of £188,000 of the broadcasting concerns, 74.5 per cent. of the shares was held by the German post office and municipal and local authorities, &c., only 25.5 per cent. being in private hands. Large sums were applied to reserve and depreciation, the shareholders receiving a dividend of 7½ per cent., which absorbed £14,100, leaving a balance of about £55,000 to be carried forward.

International Broadcasting.—FIRST COMPOSITE CONCERT.—On January 3rd an international concert, to which Germany, Belgium, and Great Britain each contributed a part, was broadcast from British and certain Western European stations. The concert was relayed from studios in Cologne, Brussels, and London to the broadcasting stations by means of telephone lines specially prepared for the transmission of musical frequencies.

The King's speech, when he opens the international conference on naval disarmament at the House of Lords on January 21st and subsequent speeches, will be broadcast. The B.B.C. has arranged to broadcast the ceremony from (5SW) Chelmsford, primarily for reception throughout the Empire. Through the International Broadcasting Union at Geneva the B.B.C. has offered facilities for relaying the proceedings by telephone line from Savoy Hill, or by wireless link from Daventry (5XX) to broadcasting organisations throughout Europe. Also the National Broadcasting Company of the United States is arranging to relay the speeches through its chains of stations, and broadcasting organisations in other parts of the world will probably make similar arrangements.

Regional Transmission.—R.M.A. TESTS.—Tests were carried out recently in order to investigate complaints respecting the twin-programmes which the B.B.C. commenced broadcasting from Brookman's Park a month ago. Mr. L. McMichael, A.M.I.E.E., undertook the tests with a four-valve portable set, and was accompanied by another radio authority and an official of the Radio Manufacturers' Association. The party started testing by the roadside in various parts of North London and Hertfordshire at 11.40 p.m. and continued until midnight. At every point it succeeded in getting perfect reception, and was able to separate the two programmes with ease. The last halt was made at the gates of Brookman's Park, when not only were the twin-programmes separated and heard clearly, but several Continental stations, including Berlin and the Eiffel Tower, were also received. The tests proved that twin-programmes are easily obtainable on the right kind of set, and, therefore, there is no necessity for the B.B.C. to make any alteration in the system to be used at its new stations to be erected at Slaithwaite for the north, Larbert for Scotland, and Bristol for the west country.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Army Contracts.—Manufacturers who are not already on the War Office list of tenderers, and may wish to be invited to tender for army requirements of cables, electrical plant, electrical and wireless stores, and scientific instruments, should apply to the Director of Army Contracts, Caxton House (West), Tothill Street, Westminster, S.W.1. (See this issue.)

Australia.—MELBOURNE.—Posts and Telegraph Department. February 18th. Jacks and number plates. (B.X. 5940.)*
February 25th. Jumper rings and terminal strips. (B.X. 5941.)*
February 25th. Switchboard plugs. (B.X. 5998.)* Magneto and c.b. telephones and automatic dials. (B.X. 5999.)*
February 25th. Telephone switches. (B.X. 6018.)*
February 10th. State Electricity Commission of Victoria. Two 6,008-kVA, 3-phase transformers with spare coils and bushings. (B.X. 6014.)*
February 26th. Victorian Railways. Deaerators and accessories. (A.X. 8935.)*

Bath.—January 22nd. Electricity Department. Supply of one 60,000-lb. boiler, one 7,000-kW turbo-alternator, and e.h.p., h.p. and l.p. cables required over a period of 12 months. (January 3rd.)

Blackpool.—CORPORATION.—Supply of six 6,600-V, 50-cycle, 3-phase sub-station switchboards. (See this issue.)

Dundee.—January 15th. Electricity Department. Supply of two 300-kVA outdoor-type transformers and one 200-kVA outdoor-type transformer. (December 20th.)

Grimsby.—January 23rd. Electricity Department. One 10,000-kW, 3-phase turbo-alternator with condensing plant. (December 27th.)

India.—South Indian Railway Co., Ltd. January 24th. Madras improvements (electrification): Cables and accessories. (December 27th.)

Liverpool.—January 23rd. Corporation. Supply and delivery for twelve months ending March 31st, 1931, of cables, meters, lamps, lubricating oils, and other materials. (January 3rd.)

London. — CENTRAL ELECTRICITY BOARD. — January 20th. Supply, delivery, and erection of 3,300-V, 6,600-V, and 11,000-V switchgear for connecting the Board's supply to undertakers' busbars, North-West England and North Wales Scheme. (December 13th.)
February 1st. Supply, delivery, and erection of 33,000-V overhead transmission lines for the South-East England Electricity Scheme, 1927. (January 3rd.)
ISLINGTON.—Borough Council. January 17th. Electrical and engineers' stores for one year commencing April 1st next. (December 13th.)
FULHAM.—January 16th. Parish Guardians. Supply and installation of a new automatic relay-type internal telephone system. (See this issue.)

Maidstone.—January 16th. Committee of Visitors. Electrical installation for lighting, heating, &c., at the Mental Hospital, Barming Heath. (December 20th.)

Manchester.—January 18th. Waterworks Committee. Supply, delivery, and erection at Haweswater, Westmorland, of three 275-b.h.p. heavy-fuel oil engines. (January 3rd.)
January 24th. Electricity Committee. Sheet-steel neutral earthing cubicles, &c., for power transformers at Cumberland Street sub-station. (See this issue.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. February 3rd. Protector blocks made of carbon and porcelain. (B.X. 5948.)*
February 13th. Opal lamp caps. (B.X. 5955.)*
January 21st. Telephone cable. (B.X. 6032.)* Six conductor telephone cordage. (B.X. 6030.)*
January 28th. Three conductor plugs. (B.X. 6028.)*
January 30th. 500 bell receivers. (B.X. 6029.)*
AUCKLAND.—January 18th. Waitemata Electric Power Board. 11,000 V, 3-phase transformers. (B.X. 6027.)*

South Africa.—LOUIS TRICHARDT.—February 18th. Municipal Council. Supply and erection of a distribution system for the town, including the supply of poles, copper conductors, transformers, meters, &c. (B.X. 6003.)
JOHANNESBURG.—February 13th. S. A. Railways and Harbours. Electric tube butt welding set. (B.X. 6005.)
South African Railways and Harbours.—January 16th. Telegraph material. (A.X. 8990.)*

Stalybridge.—January 15th. Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board. Structural steel framework in extension of Hartshead power station. Specifications (deposit £2 2s.) from W. H. George & Son, architects, 7, Warrington Street, Ashton-under-Lyne.

Stoke-on-Trent.—January 13th. Stoke & Wolstanton Board of Guardians. Electric light and power wiring and fittings for new nurses' home, London Road Institution. Specifications from T. Wood, clerk to the Guardians, Main Offices. Deposit £3.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birmingham.—Education Committee. Accepted :—
Extension of electric lighting system at Hartfield Crescent school.—R. H. Newton.
Installation of electric lighting at Gunter Road school.—Ellis & Ward, Ltd.
Child Welfare Committee. Accepted :—
Electric lighting installation at Hockley welfare centre.—L. Scrutton.
Public Health Committee. Accepted :—
Electric lighting installation at Little Bromwich Fever Hospital.—Etna Lighting and Heating Co., Ltd.
Renewal of batteries at Salterley Grange Sanatorium.—Pritchett & Gold & E.P.S., Ltd.
Electricity Committee. Accepted :—
Switchgear for Chester Street sub-station; conversion of a turbo-alternator at Hams Hall power station from a frequency of 25 cycles to 50 cycles per second; one 3,000-kW motor-generator set for Chester Street sub-station.—General Electric Co., Ltd.
Supply of grit-collecting plant for Prince's generating station, Nechells.—Davidson & Co., Ltd.
Switchgear extension at Summer Lane generating station and Bournville and Alma Street sub-stations.—Harland Engineering Co., Ltd.
Additional dust-extracting plant for Summer Lane electric generating station.—British Vacuum Cleaner and Engineering Co., Ltd.
Switchgear.—George Ellison, Ltd.
Motor-driven air compressor for Hams Hall power station.—Belliss & Morcom, Ltd.
Ash-handling plant for Prince's generating station, Nechell.—New Conveyor Co., Ltd.
Extension of pipework for ash-handling plant.—Brightside Foundry & Engineering Co., Ltd.
Frequency changers and switchgear.—English Electric Co., Ltd.
Ash disposal plant for Hams Hall power station.—E. E. Jeavons & Co., Ltd.
Ash sluicing plant for Prince's generating station, Nechells.—E. C. & J. Keay (1926), Ltd.
Modifications to the pumping plant in connection with the ash sluicing system at Prince's generating station, Nechells.—Pulsometer Engineering Co., Ltd.

Doncaster.—Town Council. Accepted :—
Wiring 180 houses at Intake for electric light (£742).—Building & Colliery Supply Co., Ltd.

Eastbourne.—Electricity Committee.
The undermentioned tenders were received for the distribution lines to East Dean :

Power Lines Construction Co., Ltd.	£2,852
W. T. Henley's Telegraph Works Co., Ltd. ...	2,537
Pirelli-General Cable Works, Ltd.	3,053
Crompton Parkinson, Ltd.	2,807
Johnson & Phillips, Ltd.	2,739

The tenders were referred to the consulting engineer.

Liverpool.—Electric Power & Lighting Committee. Recommended :—
Twelve 750-kVA, 3-phase transformers (£3,348).—English Electric Co., Ltd.

London.—Booth Steamship Co., Ltd.
12 months' supply of electric lamps.—Siemens Electric Lamps & Supplies, Ltd.

Manchester.—Electricity Committee. Accepted :—
Static transformers.—Crompton Parkinson, Ltd.; English Electric Co., Ltd.; Ferranti, Ltd.; C. A. Parsons and Co., Ltd.
Replacement of electric tower wagon battery.—Chloride Electrical Storage Co., Ltd.
6,600-V feeder extension at Dickinson Street station.—Ferguson, Pailin, Ltd.
Steam valves for turbine at Stuart Street station.—Dewance & Co.
Electric cookers.—Revo Electric Co., Ltd.
Waterworks Committee. Accepted :—
Cables, Longdendale.—Metropolitan Electric Cable and Construction Co., Ltd.

Rotherham.—Electricity Committee. Recommended :-
Cable (£6,410).—Hogan & Wardrop.
Five h.p. switches with automatic control (£688).—A. Reyrolle & Co., Ltd.
Two soot blowers (£920).—C. P. Parry, Ltd.

Salford.—Tramways Committee. Recommended :—
Equipment for tram and 'bus department (£150).— R. A. Lister & Co., Ltd.; (£1,110), Ransomes & Napier, Ltd.

Sheffield.—Electricity Committee. Accepted :—
Three ring main switchgear equipments for sub-station requirements (£487).—A. Reyrolle & Co., Ltd.

South Africa.—CAPE TOWN.—Improvements Committee. Accepted :—
3,000 electric lamps for pavilions and pier (£162).—Auto Electric Supply (Cape), Ltd.
Motor-generator for bioscope set (£116).—S.A. General Electric Co., Ltd.
Electricity Committee. Recommended :—
H.p. and l.p. switchgear (£6,741).—A. Reyrolle & Co., Ltd.
250 fuses (£331).—A. Vaux, Ltd.
Fine solder and plumbers' metal (£600).—British General Electric Co., Ltd.
Copper and galvanised iron wire (£4,609).—British Insulated Cables (S.A.), Ltd.

Tenterden.—Town Council. Accepted :—
Installing electric light in houses at Shrubcote and Danemere.—C. Milsted & Son.

Forthcoming Events.

Royal Society of Arts.—Friday, January 10th. John Street, Adelphi, W.C. 4.30 p.m. "The Economic Progress of India." Sir Basil P. Blackett.

Electrical Power Engineers' Association (Glasgow Section).—Friday, January 17th. "Metal-clad Switchgear." Mr. T. Clothier.

(South Wales Section).—Wednesday, January 15th. Grand Hotel, Cardiff. 8 p.m. "Electrical Equipment of Factories." Mr. R. H. Rawll.

Association of Mining Electrical Engineers (Western Sub-Branch).—Swansea. Saturday, January 11th. "Some Considerations *re* Power Cost." Mr. S. T. Richards.

(South Wales Branch).—Saturday, January 18th. Cox's Café, Cardiff. 6.30 p.m. Annual dinner.

Association of Supervising Electrical Engineers.—Saturday, January 11th. Children's party.

Institution of Electrical Engineers.—Informal meeting. Monday, January 13th. Institution, Victoria Embankment, W.C. 7 p.m. Discussion on "Efficiency." Opened by Mr. A. Morgan.

(Wireless Section).—Wednesday, January 15th. Institution, Victoria Embankment, W.C. 6 p.m. "A Method of Measuring the Overall Performances of Radio Receivers." Mr. H. A. Thomas.

(North-Eastern Centre).—Monday, January 13th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "Voltage Control of Large Alternators." Mr. H. W. Taylor.

(North-Midland Centre).—Tuesday, January 14th. Hotel Metropole, Leeds. 7 p.m. "Colliery Electrification." Mr. J. Scott Mackenzie.

(Scottish Centre).—Tuesday, January 14th. North British Station Hotel, Edinburgh. 7 p.m. "The Heating of Buildings Electrically by Means of Thermal Storage." Lt.-Col. S. E. Monkhouse and Mr. L. C. Grant.

(Western Centre).—Monday, January 13th. Royal Hotel, Cardiff. Annual dinner and visit of the president.

(Sheffield Sub-Centre).—Wednesday, December 15th. Royal Victoria Hotel. 7.30 p.m. "The Heating of Buildings Electrically by Means of Thermal Storage." Lt.-Col. S. E. Monkhouse and Mr. L. C. Grant.

(North-Eastern Students' Section).—Friday, January 10th. Armstrong College, 7.15 p.m. "Modern Telegraph Practice." Mr. G. W. Hastings.

(Hampshire Sub-Centre).—Thursday, January 16th. University College, Southampton. 7.30 p.m. "The Heating of Buildings Electrically by Means of Thermal Storage." Lt.-Col. S. E. Monkhouse and Mr. L. C. Grant, and "The Heat Pump: an Economical Method of Producing Low-grade Heat from Electricity." Mr. T. G. N. Haldane.

Institute of Transport.—Monday, January 13th. Institution of Electrical Engineers, Victoria Embankment, W.C. "The Co-ordination of Transport." Mr. A. Davies.

Institution of Automobile Engineers.—Monday, January 13th, Queen's Hotel, Birmingham, 7 p.m. "Petrol-electric Vehicle Characteristics." Mr. H. K. Whitehorn.

Institute of Marine Engineers.—Tuesday, January 14th. Institute, Minories, E.C. 6.30 p.m. "Water-Tube Boilers for Merchant Ships." Engr. Rear-Admiral W. M. Wayman.

International Exhibition of Cookery and Hotel Equipment.—January 14th-25th. Olympia, W.

Institution of Civil Engineers.—Tuesday, January 14th, Institution, St. George Street, S.W., 6 p.m. "Railway Traction by Oil Engines." Mr. A. E. L. Charlton. Wednesday, January 15th, 6 p.m. Informal meeting. "Development in Transportation by Cableways." Prof. S. M. Dixon.

Institute of Patentees.—Thursday, January 16th. Caxton Hall, S.W. 8 p.m. "Some Desirable Changes in Patent Law." Major Hon. H. Fletcher Moulton.

British Institute of Radiology.—Thursday, January 16th. 32, Welbeck Street, W. 8.30 p.m. Ordinary meeting.

Nottingham Society of Engineers.—Friday, January 17th. Mechanics' Institute, North Church Street. 7.30 p.m. "Surface Condensing Plant." Mr. A. Beeston.

British Electrical Development Association.—Friday, January 17th. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. "Domestic Hot Water." Mr. C. H. Smith.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

SUNRAY torches (600 ft. beam).
UNIVERSAL quick-freeze freezer.
DATUM switches.

Notes.

Legal.

ALLEGED ELECTRIC LAMP FRAUD.—At the Halifax Police Court, on January 2nd, John D. Whittaker, wool merchant's agent, Wibsey, Bradford, was committed to the West Riding Quarter Sessions on a charge of obtaining by fraud 151 electric lamps, valued at about £23, from the Wholesale Electric Supply Stores, in October last. It was stated by Mr. CLIFFORD VOWLES, partner in the prosecuting firm, that a telephone order, purporting to be by a known customer, Mr. R. B. Stafford, electrical engineer, of Halifax, was received for 151 lamps, which were supplied. Mr. Stafford, on receiving the account, said he knew nothing of the order. A youth named LAURIE NEWBY gave evidence of collecting the lamps, by request of the prisoner, on the statement that they were for Stafford. The prisoner, who asked that another case should be taken into consideration, was granted bail.

Electric Power in Rural Districts.

Mr. W. J. Minton, A.M.I.E.E., recently addressed the members of the Canterbury Farmers' Club and East Kent Chamber of Agriculture, under the chairmanship of Lord FitzWalter, on "Electric Power in Rural Districts." Mr. Minton said it had been stated that there was enough wind in Kent for the purposes of producing light for farmers, even in the stillest summer. Under the latest Act of Parliament electricity would be distributed all over the country from various points, until in the end it got down to the smallest farm. In this respect it was expected to lose money at first, but the Act would enable money to be borrowed to cover this period. There would be six main distributing areas, and the existing 442 power houses would be reduced to 182. The others would become switching and transforming centres. The voltage would be transformed to 33,000, and ultimately to 400 volts for power, and 230 volts for lighting.

Mr. Minton said that in these days sub-stations were disguised to make them look like houses in a residential area. One sub-station in an orchard in Cheshire cost £50, including the site, but excluding transformers. This sub-station was designed by a member of the Mid-Cheshire Electricity Company. The cost was reduced because the fir trees were cut down, preserved, and made ready for the lines within three weeks. Mr. Minton explained that electricity was actually being sold at a half-penny per unit, when a constant load demand was made. Oil engines were being used to-day at a cost equivalent to 1s. per kWh, whereas farmers, by combination, would be able to obtain electricity at a very much lower figure not more than an average of 4d. per kWh, including all capital expenditure and distribution, as a cautious estimate. Farmers had power to borrow money at a low rate for agricultural development, so if they combined to open up their own local centre and paid for it themselves through one meter, they would get cheap electricity.

Mr. Minton showed slides depicting electrically-controlled kitchens, various forms of electrically-driven machinery, and electrically stimulated plants. He advocated the use of batteries on a farm.

Report on Wood Boiler.

The following is a copy of a report we have received from Combustion Steam Generator, Ltd., by one of their engineers on an inspection made of one of their boilers installed at the Brighton Corporation electricity works.

"On November 25th, Mr. Ward and myself went to Brighton to inspect the condition of the inside of the tubes. The boiler had been blown down on the previous Saturday, and the doors taken off the drums on the Sunday morning. Mr. Markwick, the boiler house superintendent of the Brighton Corporation Electricity Department, Mr. Ward and myself entered the several drums. The lower rear drum was the first entered. Mr. Markwick carefully inspected several of the tubes, scraping away at the surfaces of the same, and then left us to make a very careful examination. I went from end to end of the drum, examining every tube, and scraping them with a long chisel-shaped podger. The surface of the tubes was naturally covered with rust, owing to their exposure to the air when drying out, but this was easily rubbed away with the fingers. There was not the slightest trace of scale to be found anywhere, except the top tubes in the water screen at the extreme ends of the drum. In these two extreme tubes I was able in one or two places to scrape off a slight trace of scale. The amount which flaked off would not cover more than a surface of about 2 sq. in. It could not have been more than 2/1,000th of an inch thick, and it crumbled up in the fingers when trying to take hold of it. The tubes in the middle of the drum were as clean as the day they were rolled in. There was a very slight sediment at the bottom of the drum in the very middle, similar to what has been observed at Manchester, showing that the action of the water is to rush through the downcomers and sweep to the centre of the drum. The sediment would not be much more than one handful. On entering the front lower drum, an examination was made of the other ends of the tubes, and here in every instance the tubes were perfectly clean, without the slightest trace of scale. The vertical tubes in the front and rear wall had no trace whatever of scale, as you would expect from the condition in which we found the water screen. Entering the top front drum, we examined the other end of the vertical tubes and the ends of the roof tubes. Here again, the conditions were perfect. I expressed the opinion to Mr. Markwick, after the examination, that it was the cleanest boiler I had examined, with which he concurred. When one considers that this boiler has been steaming for 2,000 hours and has had water in it for ten months, with the exception of a short period, it is a remarkable testimony to the circulation to find it in such condition. We also entered the furnace. A gang of men had been brushing down the walls, so that we were not in a position to say how the boiler had opened out, but considering the fact that the brushes they used were not particularly hard and that we found the tubes in a perfectly clean condition, the furnace could not have been in a very bad state. The corner brickwork is extremely good, the joints of the brickwork for three-quarters of the way up the furnace being clearly visible. The roof also was comparatively clean. There was a little ash adhering to the bricks, but this was easily broken off and Mr. Markwick arranged to have the roof thoroughly cleaned. We also carefully examined the fins on the tubes and there was not the slightest sign of these burning away. The edges were in practically the same condition as when the boiler was erected."

Appointments Vacant.

Meter and instrument tester for Preston Corporation. Assistant divisional telegraphs engineer for the Indian Post and Telegraphs Department. Meter fixer and reader for Hornsey Borough Council. Installation and consumers' engineer for York City Council. Distribution engineer for the West Midlands Joint Electricity Authority. Rolling stock and overhead equipment superintendent for Darlington Corporation. Power station shift engineer for the First Garden City, Ltd. Engineering assistant for the Electricity Commission. Junior mains assistants for Battersea Borough Council. Engineer and manager for Carnarvon Corporation. Junior assistant for Consumers' Department of the Leicestershire and Warwickshire Electric Power Co. Chief assistant and station superintendent for Watford Borough Council. (See our advertisement pages to-day.)

Hydro-Electric Schemes in Ceylon.

The Ceylon Legislative Council, in scrutinising the Budget for 1929-30, discussed the Government proposals on the hydro-electric projects in Ceylon. Mr. J. H. Pitkeathly, director of electrical undertakings, reviewed the Watawala scheme under consideration and evinced optimism as regards the future of electricity in Ceylon. He confirmed the total estimated cost of the Watawala hydro-electric works as Rs. 135 lakhs, and estimated that there would be a return of 5¼ per cent. on the whole capital on the first year and 6¼ per cent. on the fifth year, with current supplied at from 7 to 5¼ cents per unit. In view, however, of the great initial cost of the scheme and the availability of current at present from the recently constructed Kolonawa project, all of which it will take a few years for the country to utilise, it has been decided to postpone the development of the works at Watawala for at least a year or two.

Electricity in Baroda.

Baroda, a leading Indian State with a population of 21 millions, shows good progress in electrical development during the past year. The electrical installations at Baroda, Dabhoi, Sidpur, and Navsari are working satisfactorily, and the total connected load of these installations is 3,415 kW, an appreciable increase on the figure for previous year. Two more power houses will shortly commence working at Karjan and Pattan, and electricity will be made available to six large towns in the States. Owing to rapid increase in demand the capacity of the Diesel engines at the Baroda power house was increased from 1,070 to 2,000 kW. The Diesel oil engines at the Navsari electricity works have a capacity of 200 kW, and at Dispur of 175 kW. The Dabhoi electricity works is a small station worked by a 169-kW oil engine, the total load connected being 139 kW for lighting and 30 kW for power.

Telephony in India.

The progress of long-distance telephony in India continues apace, and the prospects are that with the extension of trunk telephone communication throughout the interior areas of India, the possibility of linking the system with Europe will be considered. Interest in this connection centres on an announcement made some time ago by a Calcutta newspaper that its representative at Karachi had a conversation on August 2nd with a *Daily Mail* reporter in London, by "telephone over the Indo-European telegraph line." After an exchange of wishes, London acquiesed in a statement that the achievement of a direct conversation between two individuals in London and Karachi, respectively, over 6,000 miles of cable and land line showed how close in point of time, thanks to modern efficiency in telegraph equipment, India and England have been brought. In the absence of details it is not clear how the communication was actually effected. The network of the general trunk telephone system in India is at present chiefly confined to the region extending north-westwards from Calcutta, through the United Provinces, the Gangetic Valley, and the Punjab to the North-west Frontier stations. This widely extended system is connected with Bombay, through Baroda, Rutlam, Agra, and Delhi. The most advanced point of communication is the outpost of Landi Khana on the Afghan border, a distance of 1,487 miles by rail from Bombay. Extensions are being made in South India as well. The total number of telephone exchanges owned by the Indian Telegraphs Department at the end of the last official year (1927-28), was 280, with 1,754 straight line connections and 2,478 extension lines. There were also 323 non-exchange systems, with 919 telephone instruments. The revenue earned during the year was Rs. 34½ lakhs. In addition there were 18 licensed companies with 31,883 connections, realising an income of Rs. 68 lakhs. The wire mileage of telephones was 25,818, and of cable 630 miles.

The Australasian Tramway Conference.

At the invitation of the Melbourne and Metropolitan Tramway Board, representatives of the tramway undertakings of Sydney, Brisbane, Adelaide, Hobart, Launceston, Ballarat, Bendigo and Geelong met in Melbourne in November to discuss problems which confront those concerned in the operation of tramway systems in Australia, says the *Industrial Australian and Mining Standard*. The chairman of the Melbourne Tramways Board (Mr. A. Cameron) was elected chairman of the conference, with the secretary of the same body (Mr. R. A. Spencer) secretary. It was decided to constitute the Australasian Tramway Conference to meet annually. The subjects to which attention was devoted included the existing obligations of tramways with regard to the construction and maintenance of street surfaces, rail corrugation, the reduction of tramcar noises, the improvement of rolling stock, the provision of safety features, the place in street transport of tramways, motor-'buses, and railless cars, the co-ordination of regulations, and the future of street transport.

Wave-Mechanics of Alpha-ray Tracks.

In a note in the December number of the *Proceedings* of the Royal Society, Mr. N. F. Mott discusses the apparent contradiction between the wave-mechanical theory of radioactive disintegration, according to which an α-particle leaks out from its parent nucleus as a spherical wave, and its particle-like attribute of leaving an almost linear trail in a Wilson cloud chamber. The discrepancy is, of course, only apparent. The wave of the α-particle must not be considered by itself, but as contributing to a wave-function in a space of many dimensions formed by the co-ordinates, both of the α-particle and of every atom in the expansion chamber. Mr. Mott develops the appropriate theory for the case when there are two atoms of hydrogen present, and finds that both must lie within a cone of small angle, having its apex at the radioactive nucleus, if they are both to be ionised. In other words, the α-particle should, apart from collisions with atomic nuclei, leave an almost straight trail. Mr. Mott's paper is an elaboration of one of the points raised by Prof. C. G. Darwin, in his paper on collision problems in wave mechanics, in the June issue of the *Proceedings*.

Electricity Supply in Portugal.

The electrical division of the General Administration of the State Hydraulic Service of Portugal has lately issued a 140-page report on the progress of electricity supply in the republic during 1928. The report consists mainly of statistics, but they are exhaustive, embracing records of the installed capacity of all the hydro, steam, oil, and producer-gas electric power stations in the country; the output and consumption during 1928 and 1927, the percentages of the different uses to which the power was applied during the two years, the consumption in kWh per consumer and per inhabitant, details of all the public and private generating plant in the country, details of the underground and overhead transmission lines of from 2,000 to 75,000 h.p., and a list of all the concerns, municipal and private, supplying electric power throughout Portugal.

An analysis of the return shows that there are now 69 installations of hydro-electric plant in the republic, with an installed capacity of 33,634 kW, 42 of them (28,110 kW) being owned by local authorities or companies, and 27 (5,524 kW) being private plant. Of plant operated by steam and internal-combustion engines there are 285 with a total of 102,088 kW; of them 116 (67,189 kW) are municipal and public company owned and 169 (34,899 kW) private. Of the 285 sets of plant, the 102,088 kW total is made up of 82,418 kW steam, 13,187 kW oil, and 6,483 kW producer gas. The total of all power plant in Portugal is 354, with a combined capacity of 135,722 kW. The output of power in 1928 amounted to an aggregate of 216,865,558 kWh, as against 186,995,246 kWh in the preceding year. The hydro-electric plant was responsible for 68,041,501 kWh of the total, an advance of 24.31 per cent., and the steam and internal-combustion engine stations for 148,824,057 kWh, a progress of 12.52 per cent., the gross output showing an increase of 15.97 per cent. over that of 1927. The following table shows the percentages of the different uses of electricity in Portugal during 1928 and 1927 :—

	1928. Per cent.	1927. Per cent.
Lighting	30.29	32.79
Traction	28.68	28.34
Power	33.97	33.57
Electro-chemical industries	7.06	5.30
	100	100

Lisbon and Oporto are the two principal electricity-using cities of the country, they being responsible for 64,826,206 kWh and 31,671,138 kWh of the output, representing 122.16 kWh and 146.80 kWh per inhabitant per annum. The average for the whole population of the country is, however, only 33.02 kWh, although that figure is an increase of 5 kWh over that of 1927. Finally, the report shows that at the beginning of 1929 there were in the country 1,070,968 miles of transmission lines ranging in capacity from 2,000 to 75,000 V, 876,003 miles being overhead and 194,965 miles underground.

Architectural Lighting.

The Lighting Service Bureau of the Electric Lamp Manufacturers' Association of Great Britain, Ltd., has collected much data in Great Britain, as well as in France and Germany, on the subject of architectural lighting, and they are presented from the architects' point of view in the latest handbook No. 8, issued by the Bureau, entitled "Architectural Lighting."

The aim in compiling this handbook has been to present the subject of architectural lighting in such a manner that the book will be of service both to the electrical engineer and the architect. The book is divided into two sections; the first deals with the fundamentals underlying the subject, and the second presents the various applications, suitably illustrated with successful examples.

The Lochaber Plant.

An interesting function took place at the Lochaber works of the North British Aluminium Company on December 30th, when the 100 guests present included the Lochiel and Lady Hermione Cameron, Lord and Lady Abinger, Mr. George Balfour, M.P., senior partner of the firm of contractors which has carried out the hydro-electric scheme, and Mr. W. Murray Morrison, general manager of the British Aluminium Company. One of the furnaces was tapped and ladies present were the first to ladle out the molten aluminium into moulds. The furnace rooms were then visited, and the party inspected the power house wherein over 30,000 kilowatts of plant has already been installed. Making full use of its own products, the company has installed aluminium conductors throughout. The Lochiel thanked Mr. Murray Morrison and the directors of the British Aluminium Company for having

afforded the people of the district that opportunity of inspecting the works, and of seeing the first cast of aluminium made at Lochaber. In returning thanks, Mr. Murray Morrison emphasised the informality of the meeting. The works had been years in the building, and though they appeared large that day, they would in the future be very much larger. If, as he hoped, they obtained further Parliamentary powers, Lochaber would probably be amongst the largest producers of aluminium in the world. Personally, he had been working for 14 years towards that end, and it was a very proud day for him to witness the first aluminium produced in that historic region. In connection with other mooted power schemes, much had been made of the alleged disfigurement of the countryside, but so far as their works were concerned, he thought no one could truthfully say that anything had been done derogatory to the beauty of the Highlands of Scotland. As the guests departed they each received an ingot of aluminium cast that day and bearing the impress "Lochaber, December, 1929."

On January 3rd, Mrs. Murray Morrison closed the switch which electrically detonated nearly two tons of explosives in the final charge in the barrier of rock at Loch Treig, which act was followed by a sound like the noise caused by a light shell inflight, accompanied by a slight vibration. No *débris* was thrown up, not even a column of water, for it should be noted that the explosion took place at a depth of over 100 ft. below the surface. After a few seconds there was a churning of the Treig waters, which turned from white to yellow. Inspection later showed that everything had gone off as was expected, so that the 15-mile tunnel is now being fed from Loch Treig, the chief reservoir. A special meeting of the proprietors of the Lochaber Power Company will be held at Adelaide House, King William Street, London, E.C.4, on January 28th for the purpose of considering and, if thought fit, approving the Provisional Order for which application has been made to the Secretary of State for Scotland, intitled "(Draft) Provisional Order to extend the period for the completion of certain works authorised by the Lochaber Water Power Act, 1921; to extend the area of supply of and confer further powers upon the Lochaber Power Company; and for other purposes."

Educational.

A course of lectures on synthetic resins, moulding powders, and plastics will commence on January 22nd at the Borough Polytechnic Institute, Borough Road, S.E.1. (See our advertisement pages to-day.)

Another Italian Diesel Ferry.

The Italian State Railways have ordered a second ferry ship from the Cantiere Federale, Genoa. It will be of 4,000 tons deadweight, 360 ft. long, with a beam of 56.5 ft. and a depth of 12.6 ft., says the *Motorship*. Three Fiat Diesel engines will drive electricity generators at 360 r.p.m., and each will develop 2,200 b.h.p., giving a total of 6,600 b.h.p. The engines have eight cylinders and are of the single-acting two-stroke type with cylinders 450 mm. bore and a piston stroke of 450 mm. One auxiliary set comprises a 280-b.h.p. Fiat four-cylinder Diesel engine running at 270 r.p.m. coupled to an electricity generator.

The Electrical Association for Women.

The visit of the Electrical Association for Women to the Ideal Home Exhibition was a very popular event last year, and a number of members were disappointed at not being able to attend owing to the late hour in which they sent in their applications. It is therefore suggested that members should send in their applications for tickets and other particulars as early as possible.

Edison Swan Electric Co., Ltd., have kindly promised to make all arrangements for conveyances for the visit to their Ponders End works on March 27th, and it is necessary that members should send in their names by the time stated on the programme, if they wish to attend.

As a desire has been expressed by many members for the E.A.W. badge to be made in the form of a brooch, it is now possible to obtain from the E.A.W. headquarters a very attractive bar brooch in silver and enamel, price 3s. each, post free.

The annual general meeting of the Association will be held in London on May 15th and 16th. The social functions will include a luncheon at the Hotel Cecil on the 15th and a ball on the 16th.

Electrical Technology in Bangalore.

According to the report for the past year of the Indian Institute of Science, Bangalore, the Institute made considerable progress in electrical equipment and electrical research work. The department of electrical technology is under the direction of Professor Catterson-Smith. Additions have been made to the facilities offered by the section, which now provides advanced courses of instruction to engineering graduates, supplemented by opportunities for research. A direction-finding house has been built for research in telegraphy and telephony. A Creed key-board perforator, a Wheatstone high-speed automatic transmitter, and a Strowger-type automatic telephone set illustrating a 10,000-line system, have been added to the electrical communication engineering section. Numerous appliances have been added to the machinery and high-tension laboratory, and work on the new battery house has begun. The Electrical Engineering Society met at regular intervals, and many papers were read and discussed.

Among investigations carried out, are the following:—Bridge methods of measuring high voltages, measurements of the ratio and phase angle in transformers, stresses between various conductors at high voltages, and air-insulated current transformers. Power losses in dielectrics at high voltages and normal frequencies have also been censured. An experiment has also been started to study the behaviour of insulating oil at varying temperatures, with special reference to losses near the breakdown voltages. An oscillographic iron-cored transformer has been made, and the work on corona currents continued. Modulation and fading of the Bombay broadcasting transmission have been measured in the electrical communication engineering section, and daily observation made of the carrier wave-strength from this station. The relation between fading and wave-front angle at broadcast frequencies have been examined.

Bombay's Electricity Supply.

A limited liability company called the Bombay Suburban Electric Supply, Ltd., with an authorised capital of Rs. 50 lakhs, has been formed for acquiring and working the existing electrical undertaking created under the Bombay Suburban Electric Licence of 1926. This licence granted by the Government of Bombay for a period of 50 years from May 29th, 1926, authorised a private concern composed of Messrs. Killick Nixon & Co., and Callender's Cable Co., to supply electrical energy for all purposes in the southern half of the island of Salsette and the island of Tronbay. The area covers the residential areas of Bandra, Pali Hill, Khar, Santa Cruz, Juhu, Vile Parle, Andheri, Varsova, Ghatkopar, Kurla, and Vikhroli. The developments of these towns on the lines of garden cities has been a marked feature of the past five years and there is a growing demand for electrical energy. The original scheme having attained dimensions which render it desirable that the responsibility for the future development should be transferred to a joint stock company, the new company has been incorporated. The demand for supply from the company is steadily increasing, and at the end of August 31st, 1929, there were 1,100 consumers. The capital expenditure on that date amounted to Rs. 9.73,420. The consideration for the transfer of the undertaking by the vendors is that the vendors (Killick Nixon and Callender's Cable Co.) should receive in an addition to the expenditure incurred by them, Rs. 9¼ lakhs, a sum of rupees two lakhs in fully paid up shares. Only 17,000 shares of Rs. 100 each are at present issued, of which the vendors were credited with 11,000 fully paid up shares and the balance of 6,000 shares was offered for public subscription. The directors are Sir Purshotamdas Thakurdas and Mr. M. S. Captain of Bombay, Messrs. F. C. Annesley and E. C. Ried, partners in Killick Nixon & Co., and Mr. J. P. Bradshaw, representative of Callender's Cable & Construction Co. Messrs. Killick Nixon & Co., have been appointed managing agents, and Callender's Cable & Construction Co., will be the consulting, constructional, and maintenance engineers to the company. The source of power in bulk is the Dharavi receiving station of the Andhra Valley Power Supply Co., Ltd., with whom the company has a contract for the supply of energy to the full amount for 15 years.

Radio in Ceylon.

It is announced that a radio station will be established in Negombo in the near future to facilitate aerial traffic when the projected air base of the Imperial Government in the lagoon is established. In the event of the experiments proving successful, a permanent station will be established for communication with seaplanes lying in or about the air port. It is understood that the Government is contemplating the establishment of similar stations at some other towns on the coast north of Colombo.

The annual report of the Post and Telegraph Department in Ceylon gives an interesting account of radio-telegraphy there. The fitting of the new receiving apparatus is progressing, and preliminary tests carried out have been very promising. It is expected that the range at the station will thus be considerably increased. The new broadcasting studio, providing better facilities for artists, has replaced the two former small studios at the Central Telegraph Office and the University College. The number of listeners' licences has increased during the year from 905 to 1,296, and of traders' licences from 19 to 21.

A Small Madras Electricity Supply Scheme.

An interesting electrical project has been opened by the Governor of Madras at Thirupathi, one of the most important pilgrimage centres in South India. The project which cost Rs. 4½ lakhs provides for the lighting of religious institutions and streets and also the Chittur municipality. The plant is located at the foot of a range of hills known as Tirumalli and is designed to serve the several temples and States up in the hills. Three 80-kW alternators are direct driven by vertical crude oil engines of 150 h.p. each. Generation is at 400 volts, 3-phase, 50 cycles with neutral earthed. For transmitting power up the hill the generation voltage will be raised to 3,300 volts by transformers. A sub-station with step-down transformers and controlling gear is located on the top of the hills. Transmission and distribution are overhead on tubular poles 75 to 100 ft. apart, 32 ft. long and carrying bare copper conductors. The plant was supplied by Volkart Brothers, of Madras.

French Hydro-electric Research.

A department has recently been established at Bellevue, near Paris, by the French Office National des Recherches Scientifiques et Industrielles for research work on the resistance of water dams, the tests being made by means of small models of dams and mercury. A special committee of experts has been appointed, under whose supervision the tests will be conducted.

The Whitworth Society.

In July last the Society made a donation of £25 to the College of Technology, Manchester, to provide prizes for the encouragement of promising students preparing for the Whitworth Scholarship examinations. The first awards have now been made to F. F. Butterworth, Rochdale, and F. C. Thornley, Hyde. The Society hopes to make similar donations to other colleges as funds may permit.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movemenes.

Mr. R. A. CHATTOCK, who has just retired from the position of chief electrical engineer of the Birmingham Corporation Electric Supply Department, which office he has held for over a quarter of a century, was entertained to a complimentary dinner by the staff of the Department on January 3rd. Mr. E. J. Jennings, secretary of the Department, was in the chair, and over two hundred were present. During the evening Mr. Chattock was presented with his portrait in oils, painted by Mr. Bernard Munns, the presentation being made by Mr. F. Forrest, Mr. Chattock's successor. A telegram was sent by the chairman to Mrs. Chattock conveying cordial greetings and felicitations. Mr. Forrest, in proposing the toast of the guest, said that Mr. Chattock had completed a great task and had been an inspiring leader. When he first took over the office of city electrical engineer, the plant capacity was 5,000 kW. To-day it had a capacity of 250,000 kW. In the same period the energy sold had increased from 4 million kWh to 350 million kWh per annum. His work was recognised when he was elected President of the Institution of Electrical Engineers in 1925. Mr. Chattock, in acknowledging the gift and responding to the toast, said that the undertaking would not stop growing because he was leaving it. The work in the future would be more strenuous than in the past, especially having regard to the change of frequency, which would impose an enormous strain upon the resources of the Department. His successor, he knew, would carry on the work of the Department with success, and he asked them to give him their wholehearted support. During the evening musical items were rendered by members of the staff of the Department.

At a recent meeting of the Gloucester Electricity Supply and Transport Committees, it was resolved to recommend the Council to relieve the electrical engineer (Mr. F. H. CORSON) from the management of the transport undertaking, owing to the extension of the area of supply and the development of the electricity undertaking. It was also recommended that Mr. S. BILLINGTON, the present assistant transport manager, should be appointed manager of the Corporation transport undertaking at a salary of £550 per annum.

At a subsequent meeting of the Electricity Committee it was pointed out that under the proposed arrangement, Mr. Corson would lose the additional £100 per annum which he received as manager of the transport undertaking, and a sub-committee was asked to consider what action should be taken with regard to the matter.

The marriage took place at the Parish Church, Hanging Heaton, Yorks, on December 26th, of Mr. BERNARD RHODES, B.Sc., who is in charge of acoustical research in the telephone laboratory at the works of Siemens Bros. & Co., Ltd., of Woolwich, and Miss Helena Jenkinson, of Dewsbury.

Mr. J. W. ROBINSON has resigned the position of president of the London branch of the Association of Mining Electrical Engineers upon leaving the South of England, and Capt. A. C. SPARKES has accepted the office.

Mr. JOSEPH Y. SHAW, for 31 years rolling stock superintendent to the Manx Electric Railway Co., Douglas, has retired, and has been presented by the directors with a cheque, and by the staff with an engraved gold hunter watch.

On New Year's Eve the staff of the Farnworth Council electricity works presented Mr. A. J. HUTCHINSON, the chief engineer and manager, with a cut glass rose bowl and a fruit basket as a memento of his 25 years' service with the undertaking, including 20 years in his present position.

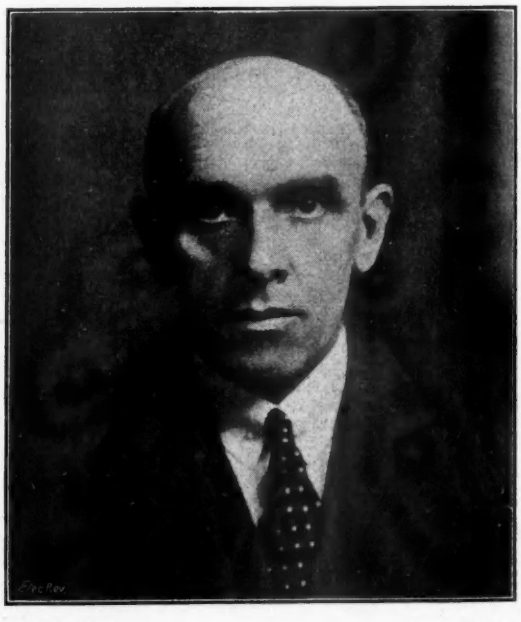
Mr. CHARLES FURNESS, electrical and tramway manager, Blackpool, on January 3rd was presented with a George I walnut tallboy from members of the Town Council, upon the occasion of his recent marriage. The presentation was made by the Mayor (Councillor G. W. Gath), who said that Mr. Furness was a man they all appreciated from personal and business standpoints. Alderman Potter said that Mr. Furness had given the town a wonderful advertisement in the form of autumn illuminations.

Mr. W. E. WARRILOW has moved to "Amber Way," Nancy Down, Oxhey, Herts.

The Coventry Corporation Electricity Committee recommends the appointment of Mr. W. J. MARSTON, assistant electrical engineer, as electrical engineer.

It is announced that Mr. DAVID SARNOFF has been appointed president of the Radio Corporation of America, while General JAMES HARBORD has become chairman, in succession to Mr. Owen D. Young, who has been elected chairman of a newly-appointed executive committee.

We are informed that Mr. E. KILSBY MUIR, M.I.E.E., has been appointed general sales manager to Messrs. J. H. Tucker and Co., Ltd., Birmingham, and that he took up his new appointment at the beginning of this year. Mr. Muir has for



Elliott & Fry] *[London*

Mr. E. Kilsby Muir, M.I.E.E.

General Sales Manager to J. H. Tucker & Co., Ltd.

many years been associated with Metro-Vick Supplies as manager of its London office, and in recent years he has been attached to the sales management of its head office.

Mr. S. A. POLLOCK, chief of the G.P.O. research station, Dollis Hill, has resigned from the service to take up a position on the technical staff of an industrial company. Mr. Pollock has been with the Post Office for 37 years, and has made important contributions to the improvement of long-distance telephone cables.

The Burnley Transport Committee on January 3rd considered applications for the position of manager, rendered vacant by the retirement of Mr. HENRY MOZLEY, and reduced the list to thirteen.

The Canterbury City Council has appointed Mr. FRANK E. LEWIS, the present assistant engineer, as city electrical engineer, in succession to the late Mr. C. A. Blascheck, at a commencing salary of £650 per annum, rising according to the annual sale of energy to £875.

The wedding took place on December 24th of Mr. F. ROSTRON, instrument sales manager to Messrs. Ferranti, Ltd. Mr. Rostron, who has been with the company for 12 years, was presented with a chiming clock and an electric reading lamp by his numerous friends in the company.

The Northern Ireland Government has secured the services of Mr. J. M. KENNEDY, M.Inst.C.E., M.I.E.E., of Messrs. Kennedy and Donkin, to advise the Ministry of Commerce on certain matters. For some time past the Ministry has had under consideration the problem of general electrical development in Northern Ireland, and Mr. Kennedy's appointment is one of the results.

Obituary.—Mr. H. J. ANDREWS.—The death occurred at Edmonton, N., on December 30th, of Mr. Henry John Andrews, late of the Indo-European Telegraphs, Persian Gulf Section. Mr. Andrews was also at one time manager of the Portsmouth Corporation telephone system. He was 80 years of age.

Mr. V. FALK.—We regret to learn that Mr. Victor Falk died on December 28th, at Bournemouth, after a short illness. Mr. Falk, who was 62 years of age, was one of the founders, in 1887, of the firm of Falk, Stadelmann & Co., Ltd. Since 1912, owing to indifferent health, he had not actively participated in the management of the business, although he still retained his position on the board of directors and maintained his interests in the company.

Professor A. A. MICHELSON.—The death was announced this week of Professor A. A. Michelson, the celebrated physicist. Professor Michelson was born in Germany in 1852, but was taken at an early age to the United States. He had held many important appointments, and was a member of the leading American and foreign scientific societies.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Charges, Transactions in Stocks and Shares.

New Companies Registered.

Whitworth Electrical Repairs, Ltd.—Private company. Registered December 28th. Capital, £1,000 in £1 shares. Objects: To carry on the business of engineers, manufacturers of electrical, wireless, gas, steam and water fittings and accessories, &c. The first directors are: W. C. Hands, 20, Northwick Avenue, Harrow, electrical engineer (director Whitworth Electric Lamp Co., Ltd.); A. E. Dawson, Frinton, Sefton Avenue, Mill Hill, N.W.7 (director of Wenham Lighting Corporation, Ltd.; F. J. Swift, 184, Gray's Inn Road, W.C.1. Qualification: Two shares. Registered office: 184, Gray's Inn Road, W.C.1.

Home Utilities (Midlands) Co., Ltd.—Private company. Registered January 1st. Capital, £500 in £1 shares. Objects: —To carry on the business of dealers in electrical or non-electrical cookers, refrigerators, vacuum cleaners, or any other electrical or non-electrical appliances. The directors are: H. Chatwin, 1, Hardwick Grove, W. Bridgford, Notts; Mary Roberts, The Ellesmere Hotel, Sheffield. Qualification: £10 shares. Registered office: 19, Gordon House, Carrington Street, Nottingham.

A. S. Howarth, Ltd.—Private company. Registered January 2nd. Capital, £2,000 in £1 shares. Objects:—To carry on the business of electricians, mechanical engineers, and manufacturers, tool makers, metal workers, manufacturers of and dealers in all kinds of electrical and other instruments in connection with wireless telegraphy, &c. The directors are: A. S. Howarth, electrical engineer, and Mrs. E. Howarth, both of 62, Sherriff Street, Rochdale. Qualification: £50 shares. Registered office: 41, Toad Lane, Rochdale.

Domestic & Commercial Electricity (Hull), Ltd.—Private company. Registered January 2nd. Capital, £100 in £1 shares. Objects:—To carry on the business of electrical and radio engineers and contractors, radiator and sanitary engineers, &c. The directors are: C. J. Hurley (permanent governing director), 9, St. John's Grove, Hull; Mrs. Emma Hurley, 9, St. John's Grove, Hull. Qualification: £5 shares. Registered office: Mill House Yard, Southcoates Lane, Hull.

S. Gordon & Co. (Manchester), Ltd.—Private company. Registered December 31st. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electrical, wireless and mechanical engineers, contractors and merchants, dealers in electrical fittings, machinery and lamps, &c. The first directors are: S. Gordon, 92, Doncaster Avenue, Withington, Manchester, merchant; F. W. Butterworth, "Abbenwy," Lowland Road, Stockport, merchant; J. H. Roscoe, "Marbury," York Avenue, Sedgley Park, Prestwich, secretary (all permanent). Qualification: 100 shares. Registered office: 12, Cannon Street, Manchester.

D. Lloyd Lewis, Ltd.—Private company. Registered January 1st. Capital, £1,000 in £1 shares (400 10 per cent. cumulative preference and 600 ordinary). Objects:—To carry on the business of electricians, mechanical engineers, suppliers of electricity, manufacturers of and dealers in electrical apparatus, lighting sets, and chemicals, automobile electrical and telegraphic and telephonic engineers, &c. The first directors are: P. Forrester, Ballochmyle, Blundellsands, Liverpool; and D. Lloyd Lewis, 330, Walton Hall Avenue, Walton, Liverpool. Qualification: 10 ordinary or preference shares. Registered office: 76, Duke Street, Liverpool.

Ryland's Electrical Co., Ltd.—Private company. Registered January 2nd. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electrical engineers, contractors and agents for and factors of electrical equipment, &c. The first directors are: F. W. Ryland, electrical engineer, and Mrs. W. Ryland, both of 42, Goodmayes Road, Goodmayes. Qualification: 5 shares. Registered office: York House, 42a, Goodmayes Road, Goodmayes.

The Northern Rhodesia Power Corporation, Ltd.—Registered as a private company January 3rd. Capital, £330,000 in £1 shares. Objects:—To carry on the business of an electric supply company in all its branches, and to adopt an agreement with Bwana M'Kubwa Copper Mining Company, Ltd. The subscribers (each with one share) are: J. S. Metzlar, 13, Hyde Park Gate, S.W.7, director of Rhodesian Anglo-American, Ltd.; E. Davis, 13, Lansdown Road, W.11, director of British South Africa Company. Each of the following companies, *viz.*:—The British South Africa Company, Rhodesian Anglo-American, Ltd., and Rhodesian Selection Trust, Ltd., have the right to nominate three directors. So long as one of the directors nominated by the first-named company shall be president of that company, he shall be chairman of the board. Registered office: 4, London Wall Buildings, E.C.2.

Official Returns of Electrical Companies.

T. H. Satchwell, Ltd.—Capital, £3,000 in £1 shares. Return dated October 18th, 1929. 2,502 shares taken up. £1,252 paid. £1,250 considered as paid. Mortgages and charges, nil.

Delhi Electric Supply & Traction Co., Ltd.—Capital, £200,000 in £1 shares. Return dated July 31st, 1929. All shares taken up. £121,000 paid. £79,000 considered as paid. Mortgages and charges, nil.

Alert Electrical Co., Ltd.—Capital, £2,000 in £1 shares. Return dated February 28th (registered September 6th), 1929. 708 shares taken up. £708 paid. Mortgages and charges, nil.

Chadburn's (Ship) Telegraph Co., Ltd.—Capital, £120,000 in 60,000 preference and 60,000 ordinary shares of £1 each. Return dated July 11th, 1929. All shares taken up. £100,000 paid on 50,000 preference and 50,000 ordinary shares. £20,000 considered as paid on 10,000 preference and 10,000 ordinary shares. Mortgages and charges, nil.

Crosland, Ltd.—Capital, £2,000 in £1 shares. Return dated September 25th, 1929. 1,002 shares taken up. £1,002 paid. Mortgages and charges, nil.

Coventry Electrical Appliances, Ltd.—Capital, £10,000 in £1 shares. Return dated August 7th, 1929. 5,187 shares taken up. £5,137 paid. £50 considered as paid. Mortgages and charges, nil.

Edward Dewhurst, Ltd.—Capital, £20,000 in £1 shares. Return dated October 23rd, 1929. 15,672 shares taken up. £1,502 paid. £14,170 considered as paid. Mortgages and charges, nil.

George H. Tozer, Ltd.—Capital, £3,000 in £1 shares. Return dated August 6th, 1929. All shares taken up. £901 5s. paid (being £1 per share on 5 shares, and 5s. per share on 1,195 shares). £1,800 considered as paid on 1,800 shares. Mortgages and charges, nil.

Palestine Electric Corporation, Ltd.—Trust deed dated December 18th, 1928, charged in addition to property in Palestine, on lands, tenements, and real and immovable property in any other part of the world, plant and machinery, and the company's undertaking and property, present and future, including uncalled capital, on which £250,000 and premium of 2 per cent. was owing on November 1st, 1929. (Now registered pursuant to Section 91 of the Companies Act, 1929.) Mortgagees: Prudential Assurance Co., Ltd., 142, Holborn Bars, E.C.1.

Northampton Electric Light and Power Co., Ltd.—Particulars filed of £400,000 debentures (inclusive of £286,000 already registered) authorised by resolutions of March 11th, 1924, October 21st, 1926, and November 12th, 1929, and covered by trust deed dated December 10th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital (ranking *pari passu* with trust deed securing £200,000 debenture stock dated June 2nd, 1924, and supplemental trust deed securing an additional £86,000 debenture stock dated November 9th, 1926), the amount of the present issue being £114,000. Trustees: C. A. Markham, Northampton, and others.

Scattergood & Johnson, Ltd.—Capital, £10,000 in 2,000 preference and 8,000 ordinary shares of £1 each. Return dated August 22nd, 1929. 7,928 ordinary shares taken up. £1,252 paid. £6,676 considered as paid. Mortgages and charges, nil.

Philips Lamps, Ltd.—Capital, £'00,000 in £1 shares (increased from £50,000 on August 27th, 1929). Return dated July 17th, 1929. 50,000 shares taken up. £50,000 paid. Mortgages and charges, nil.

H. A. Stonham & Co., Ltd.—Capital, £1,200 in £1 shares. Return dated September 9th, 1929. All shares taken up. £1,200 paid. Mortgages and charges, nil.

Globe & Simpson, Ltd.—Capital, £8,000 in £1 shares. Return dated June 28th, 1929. 5,750 shares taken up. £5,100 paid. £650 considered as paid. Mortgages and charges, nil.

Premier Wholesale Electric Co. (Stockport), Ltd.—Capital, £2,000 in £1 shares. Return dated August 8th, 1929. 1,200 shares taken up. £850 paid (including £50 paid on 100 forfeited shares). £400 considered as paid. Mortgages and charges at date of return: £255 12s. 11d. (since paid off).

L. J. Healing & Co., Ltd.—Capital, £100,000 in 5,000 preference and 5,000 deferred shares of £10 each. Return dated May 18th (filed October 19th), 1929. 2,101 preference and 5,000 deferred shares taken up. £16,010 paid. £55,000 considered as paid. Mortgages and charges, nil.

Ecco Radio, Ltd.—Capital, £3,000 in £1 shares. Return dated June 10th, 1929. 2,397 shares taken up. £2,397 paid. Mortgages and charges, nil.

Curtis Manufacturing Co., Ltd.—Capital, £6,000 in £1 shares. Return dated August 30th, 1929. All shares taken up. £1,000 paid. £5,000 considered as paid. Mortgages and charges, nil.

Holophane, Ltd.—Capital, £100,000 in £1 shares. Return dated October 11th, 1929. All shares taken up. £7 paid. £99,993 considered as paid. Mortgages and charges, nil.

Tamplin & Makovski, Ltd.—Satisfaction to the extent of £13,264 on December 11th, of debentures authorised by resolutions of August 23rd and September 18th, registered October 11th, 1929.

City Notes.

Bogota Telephone Co., Ltd.

The annual meeting of this company was held on December 31st. Mr. H. S. Bennett, who presided in the absence of Sir Alexander Roger (chairman), said that since the company became identified with the Cable, Telephone & General Trust, Ltd., in May last, an energetic policy had been adopted, first, to supply service to the waiting applicants in Bogota, and second, to plan for the future so that Bogota would have a telephone service of the highest order. For the purpose of expediting the completion of the work of installing the new switchboard in the main exchange, and also of laying and connecting up the underground cables through which the lines to the subscribers' premises passed, the engineering staff in Bogota had been doubled, and part of the new switchboard was already in use. During the year approximately 1,000 new stations were added, and for the first five months of the current year almost a like number already had been connected up. Practically all the waiting subscribers would be connected after the completion of the installation of the switchboard in March next. An addition had also been ordered for the new Chapinero exchange. In addition to the foregoing, an engineering survey had been completed, and plans were now in preparation for the supply of adequate equipment to meet the demand for the next ten years. Also an arrangement had been made with the Cia. Telefonica Central for connection between the Bogota local system and the long-distance toll lines now under construction so that Bogota subscribers would be provided with facilities for through communication with the seaport of Buenaventura and the intermediate cities of Cali, Manizales, Ibague and Girardot. The report and accounts were adopted.

Foundation Co., Ltd.

It was announced this week that owing to a heavy lock-up of capital abroad, the directors are unable to provide the interest on the secured notes and the dividend on the preference shares, due on January 1st. In order to protect the position, a receiver (Mr. J. H. Stephens, 6, Clement's Lane, Lombard Street, E.C.), has been appointed by the Court of Chancery. It is hoped to make arrangements to secure the continuance of the work on a number of important contracts for various public authorities. The Foundation Co., which is controlled by an American company of the same name, has an issued capital of £425,000. The note issue of £150,000 was due for repayment on December 31st last, but the term has been extended for two years. An issue of 75,000 £1 preference shares was made to shareholders last year when one ordinary share was allotted for each five preference shares taken up.

Bengal Telephone Corporation, Ltd.

The net profit for the year ended June 30th last was Rs. 7,98,209, to which is added Rs. 32,898, brought forward, making Rs. 8,31,107. After deducting the preference dividend and appropriating Rs. 75,000 to write down value of multiple jacks and switchboard cable in stores, it is proposed to pay a dividend of 8 per cent. on the ordinary shares, leaving Rs. 56,203 to be carried forward. The number of telephone services maintained by the company at the close of the year were, exchange lines 10,698, extensions 3,714, and private lines 598.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

Cables and Wireless, Ltd.—£113,058 7½ per cent. non-cumulative "A" ordinary stock, £50,949 "B" ordinary stock, and £119,437 5½ per cent. cumulative preference stock.

Birmingham and District Investment Trust, Ltd. (formerly Birmingham District Power and Traction Co., Ltd.). 559,780 ordinary shares of £1 each fully paid, Nos. 146,847 to 250,000 and 662,935 to 1,119,560.

Dealings in the following securities have been allowed by the Committee under Rule 159:—

Cables & Wireless.—£113,058 seven and a half per cent. non-cumulative "A" Ordinary stock; £50,949 "B" Ordinary stock; £119,437 five and a half per cent. cumulative preference stock.

Hydro-electric Securities Corporation.—126,005 shares of common stock of no par value.

Underground Electric Railways Company of London.—2,996 ordinary shares of £1 each, fully paid, Nos. 7,287,382 to 7,290,377.

International Combustion, Ltd.

The *Financial Times* says that it is authoritatively informed that International Combustion, Ltd., Kingsway, W.C., is in no way affected by the appointment of a temporary receiver for the International Combustion Engineering Corporation, of New York. The British company and all its subsidiaries are separately financed and are independent of the American company. The capital of International Combustion is £1,200,000. Neither it nor any of its subsidiaries have any mortgages or debentures outstanding, and they have had no bank overdraft at any time. The company owns the capital stock of Underfeed Stoker Co., Combustion Engineering, Derby, and several other companies in the power plant field, as well as freehold works at Derby covering nearly 20 acres.

Companies Struck Off the Register.

The names of the undermentioned companies have been struck off the Register and they are thereby dissolved:—

F. C. Brown (Electricity), Ltd.
General Battery Co., Ltd.
Midland Radiotelephone Manufacturers, Ltd.
N.S. Battery and Equipment Co., Ltd.
Skipton Electrical Co., Ltd.
Win-sum Electric Diffusers, Ltd.
Wireless Distributing Co., Ltd.

John Shaw & Sons, Wolverhampton, Ltd.

In the course of his speech at the annual meeting on December 31st, Mr. George Terrell (chairman) said that at the last meeting they were full of hope in connection with their home trade in tools and the electrical department, and they expected to be in a position to pay an interim dividend, but in the latter months of the year the sales failed to come up to expectations, and the result had been a loss. During the last six months, however, their trade in tools and electrical appliances had shown considerable expansion.

Large American Issue.

The Insull Utility Investments, Inc., announces its intention to issue shortly $60,000,000 of 10-year 6 per cent. gold debentures (series "B"). The proceeds will be devoted to the re-

demption of existing debt and the acquisition of additional securities, and will leave the company with about $20,000,000 of free cash. The company has large holdings in a number of important American utility concerns; its London associate is Insull, Son & Co., Ltd.

Prospectus.

North-West Midlands Joint Electricity Authority.—On Tuesday last this Authority offered for subscription £886,000 of 5 per cent. stock repayable at par between July 1st, 1950, and July 1st, 1970. The price of issue was 98¼ per cent. The prospectus showed that the Authority's district has an area of 800 sq. miles in Staffordshire, Shropshire, and Cheshire, and the Authority is to take over the supply to Stoke-on-Trent and Stafford in March.

Chili Telephone Co., Ltd.

The directors announce their intention of altering the company's financial year so that it ends on December 31st instead of March 31st. The accounts to be submitted at the ordinary general meeting early this year will cover the period April 1st, 1928, to December 31st, 1929.

Calcutta Electric Supply Corporation, Ltd.

As we have already reported, a special meeting is to be held to-day (Friday) to consider proposals to restrict the holding of the company's shares by foreigners. Prior to the meeting there had been some criticism of the proposals by shareholders.

British Columbia Electric Railway Co., Ltd.

A dividend at the rate of 5 per cent. per annum has been declared on the 5 per cent. cumulative perpetual preference stock for the half-year ended December 31st.

Fife Tramway, Light & Power Co.

The directors announce their intention of repaying the whole of the outstanding 5¼ per cent. 5-year registered notes, on March 31st next.

East African Power and Lighting Co., Ltd.

An interim dividend of 3 per cent., less tax, has been declared on the ordinary shares.

Altrincham Electric Supply, Ltd.

An interim dividend of 3s. 9 3/5d. per ordinary share, and 1s. 3 6/7d. per deferred share, less tax, has been announced.

Hydro-Electric Securities Corporation.

The regular half-yearly dividend of 2½ per cent. has been declared on the "B" preferred stock.

French Companies.

The *Société de Paris et du Rhône* reports net profits of 1,116,000 fr. for 1928-29, excluding the balance brought forward. The dividend is at the rate of 10 fr. per share, as compared with 9 fr. in the previous year.

The *Société Industrielle des Téléphones* realised net profits of 10,200,000 fr. in 1928-29, as compared with 7,480,000 fr. in the previous year. The dividend has been fixed at the rate of 27 fr. per share, the sum of 1,300,000 fr. has been placed to the contingency fund, and 80,000 fr. is carried forward.

The *Societe Financière Electrique*, which is the financing concern of the French Thomson-Houston group, reports net profits of 13,100,000 fr. for 1928-29, as against 11,600,000 fr. in the preceding year. The dividend is maintained at 8 per cent. on capital increased from 85,000,000 fr. to 110,000,000 fr.

The accounts of the *Etablissements Granoux et Cie* show net profits of 1,202,000 fr. for 1928-29, and the dividend is maintained at 40 fr. per share.

German Companies.

The accounts of the *Siemens and Halske Company* for 1928-29, after deducting interest on loans, writing down the value of the buildings, and devoting 5,744,000 marks to legal social welfare purposes and 3,386,000 marks to voluntary social purposes, show net profits of 18,718,000 marks, as compared with 18,453,000 marks in the previous year. It is proposed to maintain the dividend at the rate of 14 per cent.

The *Siemens-Schuckert Works Company* reports net profits of 16,639,000 marks for 1928-29, as against 16,560,000 marks in the preceding year, and the dividend is maintained at 10 per cent. This result has been attained after having made provision for loan interest, depreciation of buildings and legal and voluntary social welfare appropriations, the last two items amounting to 8,927,000 marks and 6,978,000 marks, respectively.

The *South German Telephone Apparatus, Cable and Wire Works Company* reports net profits of 346,000 marks for 1928-29, as compared with 341,000 marks in the preceding year. The dividend is maintained at 10 per cent.

Dutch Company.

The accounts of *Pope's Metaaldraad Lampenfabriek* for 1928-29 show net profits of 297,000 fl. as compared with 65,000 fl. in the previous year. It has been decided to pay off the arrears on the 6 per cent. cumulative preference profit-sharing shares amounting to 18 per cent., as well as 6 per cent. for 1928-29, together with 3 per cent. on the ordinary shares.

Stocks and Shares.

TUESDAY EVENING.

THE most cheerful factor in the present situation as regards the Stock Exchange and market prices of securities, is the continued cheapness of money. Indications point to a possible reduction of 4½ per cent. in the Bank Rate, and day-to-day money becomes, at times, difficult to lend at any remunerative rate. Why there should be this plethora of capital is difficult to explain on any assumption other than that investors are chary of locking up money in stocks and shares at a time when politics, the world over, are in a state of unrest. Industrial development is checked by the uncertainty which prevails, not perhaps so much in this country, as in India and some of the Colonies. The progress which is being made in this country in the direction of electrical development is a bright spot in an otherwise heavy background. According to advices from the United States, business in America has already recovered from the blow dealt to it by the financial crashes of last October and November, and the effect of the collapse is declared to be (like a good many thousands of small speculators) wiped out.

Money Seeking Employment.

In spite of the mild reluctance on the part of money to seek investment, it is obvious that people are not going to be content to leave their capital on deposit at the banks for some indefinite time. Faith in the business acumen of some of the leading banks has been shaken during the past few months by evidence that bankers are no more immune from temptation to take risks than other people are, and that banks are liable to sustain substantial losses. This does not affect in any way, of course, the security and stability of the banks, because the latter have vast reserves, partially disclosed, partially hidden, and the credit of British banking stands as high as ever it did. Nevertheless, the happenings of the past six months probably exercise a sentimental influence in the determination of capital to turn towards gilt-edged securities, and borrowers are not likely to overlook this disposition.

North-West Midland Stock.

An issue has been made this week of £886,000 5 per cent. stock, 1950-70, by the North West Midlands Joint Electricity Authority. The issue price is 98¼, with interest payable on January 1st and July, the first being a broken amount of 35s. per cent. due on July 1st. next. The price may appear high, but the security is unimpeachable, and the stock will go into the hands of people who, having bought it, are likely to treat it in the same way as any other gilt-edged investment. There is comparatively little gilt-edged stock on offer of the sound industrial undertakings, and the newcomer will be the more welcome on this account.

Stock on Offer.

There is on offer at the present time a modest amount of 4 per cent. debenture stock of Associated Electrical Industries, for which 74 is asked. The yield is £5 8s. per cent. on the money; and, on the basis of last year's profits, the interest on this stock was covered more than seven times. The stock can be redeemed at any time at 110. A well-secured 5 per cent. debenture stock is that of Northampton Electric Light & Power, of which there is two or three thousand pounds on offer at 95, free of stamp and fee. The yield is 5¼ per cent., and interest payments are due on January 1st and July 1st. The interest service takes £20,000 per annum: last year's profits came to £106,700. The stock is repayable at 100 in 1964, but the company has the right to redeem it between July, 1929, and December, 1935, at 105, and thereafter at 100. G.E.C. 7 per cent. mortgage debenture stock is available, as regards £5,000 stock, at 103, with interest at the end of March and September. The yield is 6¾ per cent. on the money, but the stock is redeemable by drawings at 100.

Home Railway Dividend Estimates.

The list of Home Railway stocks shows few alterations on the week. More interest than usual is taken in the forthcoming dividend declarations, especially those which are to be made by the steam companies. There would probably be an active market to-day in Metropolitan and in Districts, had it not been for the Government's announcement last month in connection with London transport. This has chilled the speculative interest which would otherwise have been aroused by the near approach of the dividend announcements. The Underground Electric Railway is expected to pay 7 per cent. for the year on its £1 shares; the District Company is thought likely to repeat its previously paid 5 per cent., and the Metropolitan to raise its dividend to 4 per cent., being an increase of ½ per cent. over the previous year's distribution. The announcements from the Underground group should be out during the first week in next month. Underground shares and the 6 per cent. income debenture are lower on the week. No alterations worth mentioning have occurred in the prices of the London tramway issues.

Indian Shares.

The unrest in India has led to a weakening of prices in certain of the industrial companies connected with the country. No particular amount of selling has come in, but, when

anxiety prevails, it is only natural that prices should be marked down more or less as a matter of precaution. Calcutta Electric Supply ordinary shares have eased off to 45s. 9d. The 5 per cent. preference remain nominally unchanged at 20s. The dividend on these is free of income tax up to 6s. in the £. Cawnpore Electric Supply ordinary shares, which are in receipt of 10 per cent dividends, fell 2s. 6d. to 27s. 6d. Delhi Electric Supply and Traction ordinary weakened to a little below 40s. Calcutta Trams stand about 14s.; the 5 per cent. preference, on which the dividend was recently paid, are about the same price. Andhra Valley Power Supply 7½ per cent. ten-year secured sterling notes have eased off to 99. Madras Electrics keep fairly steady at 26s. 3d. The 5½ per cent. preference, free of income tax, have been lowered ½ to 18s. 9d. Burma Electric Supply ordinary shares remain nominally at 15s., and the 6 per cent. preference at 17s. 6d., though it is probable that shares in both cases can be obtained for less.

Dollar Stocks.

Brazilian Tractions, at 38½, are ½ up. Shawinigan Water recovered to 80½. In other American utility stocks business has been quiet, and prices reflect the unusually placid note of the market. Montreal Light, Heat, & Power shares are 135, after being 129; Pennsylvania Water & Power are 76½. Power Corporation of Canada stand at 77½. Canadian General Electrics are 260, the preference stock 59. Mexicans are inclined to be reactionary. The Light & Power common shares receded to 72½, a fall of 2½, and the 7 per cent. preferred are 2 points down, also at 72½. Mexico Tramways remain at 30. Of the Brazilian bonds, Rio firsts are easier at 82½. There was a little pressure to realise certain of the European stocks, and Hungarian Transdanubian Electric 6½ per cent. "B" debenture stock, at 83½, is a point lower. The company's 4½ per cent. debenture is one of the Trades Facilities stocks, guaranteed by the British Government, and the price is quoted at 91.

Brazilian Tractions.

The Brazilian Traction Company has declared a quarterly dividend of half a dollar in cash, and one dollar in stock. This is by no means a novel proceeding, but it happens to be of peculiar interest owing to the fact that the Brazilian exchange has moved sharply against outside holders of Brazilian issues. Therefore, the distribution of stock instead of cash by a Brazilian company saves the company the loss that it would otherwise sustain through turning its receipts, of milreis, into sterling, dollars, or whatever other currency the dividends may be paid in as a rule. The austere will no doubt protest against what is virtually a watering of the capital, but where a company is faced with two evils, and of the two prefers to choose what it no doubt regards as being the less, the sting of criticism is thereby blunted.

Electricity Supply.

The market for electricity supply shares is very quiet. Clyde Valley shares have gone back to 35s., Electric Supply Corporations to 47s. Metropolitans, in the London list, have lost a little ground at 36s. 3d. The new issue is rather better at 5s. 6d. premium. Atlas strengthened to 27s. 9d., the preference remaining unchanged at 23s. 6d. British Power & Light shares are weak at 12s. 3d. County of London Electric new ordinary have been changing hands freely on the basis of 4s. 3d. premium. Midland Counties new shares are 26s. 9d., and Scottish Power new 27s. 6d. Northampton Electrics shaded off to 43s. 3d.; Lancashire Electrics, at 27s. 6d., are 6d. better. The City of Berlin Electric has already started to redeem part of the issue of thirty-year 6½ per cent. sinking fund debentures made last February.

Cables, Wireless and Telephone.

The Cables & Wireless group is better, with a notable rise in preference stock to 99 buyers. The "B" strengthened to 37½, which shows a gain of two points, while the "A" ordinary at 75½ is 1½ up on the week. No changes of importance have occurred amongst telephone and telegraph issues. Anglo-Portuguese Telephones are a little harder at a guinea. American Telephone and Telegraph stock strengthened to 226, and International Telephone & Telegraph to 77. The latter Corporation has lately acquired a controlling interest in the Peruvian Telephone Company, which operates in Lima and the suburbs. The International Telephone Corporation now controls the United River Plate, the Chile, the Montevideo, and the Rio Grandese Telephone Companies. The Venezuela Telephone Company still retains its independence. Burndept shares are half-a-crown.

Miscellaneous Matters.

Associated Electrical ordinary shares have risen 1s. 3d. to 27s., but apart from this the list of shares in manufacturing companies is unusually placid. The leading shares maintain their prices. British Electric Transformer preference moved back to 10s., showing a fall of 3s. English Electric ordinary at 5s. have regained their recent decline Ever-Ready Trust shares fell 2s. 6d. to 8s. 9d., upon disappointment at there being no dividend declared in the report, published this week. In the Iron and Steel group, Babcock & Wilcox are heavy at 2¾, and Vickers, after being 7s. 6d., hardened to 7s. 9d. The rubber share market is inclined to be weaker, owing to rubber having fallen to the neighbourhood of 7¾d. per lb.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend. 1927.	1928.	Price Jan. 7 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	57/6	—	5 4 4
Brompton Ordinary	1	8½	8½	25/6	—	5 9 10
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¼	8¼	25/-	—	5 12 0
City of London	1	10	10	29/-	—	4 7 6
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	1⅞	—⅛	
County of London	1	7	10	42/-	—6d.	4 15 3
do. do. 6% Pref.	1	6	6	22/-xd	—	5 9 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	47/-	—	4 13 7
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	27/6	+6d.	5 9 1
London Electric	1	8½	9	26/-	—6d.	5 7 8
Metropolitan	1	9	9	86/8	—	4 19 4
do. 4½% Pref.	1	4½	4½	17/-xd	—	5 6 0
Midland Counties	1	6½	6½	27/-	—	4 16 4
Mid. Elec. Power	1	15	8	38/9	—	4 14 10
Newcastle-on-Tyne Ordinary	1	6	6	23/9	—	5 1 1
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	10⅔	—	5 11 4
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	1	8	8	26/-	—	5 7 8
Scottish Power	1	8	8	29/-	—	5 12 3
South London	1	8½	8½	25/6	—	5 9 10
Urban Ordinary	1	7	7	33/9	—	4 3 0
Victoria Falls Ord.	1	15	15	2⅛	—	5 4 2
Westminster Ordinary	1	8¼	8¼	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	23/6	—	5 7 8
Yorkshire Elec.	1	8	8	32/-	—	5 0 0

HOME RAILS.

		Nom.					
		£					
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	"	8	8½	69½	—	5 12 0
do. District	"	4	5	72	—	6 19 0
Underground Electric	£1	5	7	31/-	—6d.	6 13 8
do. do. Income	Bonds	6	6	102	—2	5 17 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	101½	—	5 18 3
do. Def.	"	1½	1½	24½	—	6 4 5
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	99	+2½	5 11 0
do. A 7½ Ord.	"	—	—	75½	+1½	
do. B Ord.	"	—	—	37½	+2½	
Globe Tel. and T. Ord.	10	10	10	23xd	—	*4 7 0
do. do. Pref.	10	6	6	11xd	+⅛	5 9 1
Great Northern Tel.	10	20	20	29½	—	6 14 5
Indo-European	25	10	10	52½	—	*3 16 9
Marconi-Marine	1	12½	15	2½	—	
Oriental Telephone Ord	1	12	12	2⅛	—	*4 5 5

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	8xd	—	9 3 4
do. do. 2nd Pref.	5	6	6	8xd	—	10 0 0
do. do. 5% Deb.	Stock	5	5	71½	—	6 19 10
British Electric Traction Def. Ord.	"	5	5	1525	—	
do. do. Pref. Ord.	"	8	8	121½	—	6 11 9
Brazil Traction	100	7	8	38½	+½	5 4 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9
London & Sub. Trac. 5% Pref.	1	Nil	Nil	10/-	—	
London United Tram Deb.	Stock	4	4	50½xd	—	7 18 0
Mexico Trams, 5% Bonds	—	5	5	66½	—	7 10 5
Mexican Light Common	100	Nil	Nil	75	—	
do. 7% Pref.	100	7	7	72½	—2	9 13 2
do. 1st Bonds	—	5	5	74½	—	6 14 8
Yorkshire (West Riding)		Nil	Nil	5/-	—	

MANUFACTURING COMPANIES.

Assoc. Elec. Ord.	1	6	—	27/-	+1⅛	4 9 0
Babcock & Wilcox	1	13	15	2⅜	—	*5 4 4
British Aluminium Ord.	1	10	10	46/-	—	*4 7 0
British Elec. Transformer Pref.	1	7	7	10/-	—	
British Insulated Ord.	1	15	15	3½	—	3 18 9
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	1	15	15	3⅜	—	4 2 8
do. 6½% Pref.	1	6½	6½	1½	—	5 4 0
Crompton Parkinson Ord.	£/-	—	80	20/-	—	7 10 0
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 3
do. 5% Deb.	Stock	5	5	83½	—	6 1 3
Electric Construction	1	7½	6½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4⅝	—	4 2 0
English Electric	1	Nil	Nil	5/-	+1⅛	
do. do. Pref.	1	8	Nil	7/6	—	
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	9⅛	—	4 6 7
Henley	1	25	20	5½	—	5 1 6
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	11/8	—	
Johnson & Phillips	1	10	—	36/8	—	5 10 8
Siemens Ord.	1	7½	7½	25/-	—	6 0 0
Telegraph Construction	12	10	12	28	—	*5 4 2

* Dividends paid free of Income Tax.

The British Industries Fair.

Further Lists of Exhibitors.

SINCE going to press with our first list of electrical and allied exhibitors in the Birmingham division of the Fair we have received from Mr. E. J. Jennings, hon. secretary of the Electrical Section, a complete list of firms in that section. In addition to those whose names appeared in our last issue (p. 15) we note the following who are exhibiting in the Electrical Section or will display goods of an electrical and allied nature :—

A.1 Electric Welding Appliance Co.
Allday & Co., Ltd.
Bowker, S. O.
Braidwood, P. M.
British Aero-Technical Co., Ltd.
British Electric Transformer Co., Ltd.
British Furnaces, Ltd.
British Resistor Co. Ltd.
British Sangamo, Ltd.
Brown's Dryers, Ltd.
Callender's Cable & Construction Co., Ltd.
Clear Hooters, Ltd.
Coade, L. G., & Co.
Curtis Manufacturing Co., Ltd.
Dunhill, G.
Edison Swan Electric Co., Ltd.
Elliott, E.
Fielding & Platt, Ltd.
Gent & Co., Ltd.
Harper, John, Ltd.
Hewittic Electric Co., Ltd.
Holmes, W. C., & Co., Ltd.
Hope, H., & Sons.
Horstmann Gear Co.
Ingram & Kemp.
Joyner, Chas., & Co., Ltd.
Langbridge, Ltd.
Marsh, H., & Co.
Metropolitan-Vickers Electrical Co., Ltd.
Moffatts, Ltd.
Mudd, P. A., & Co.
Parker, Winder & Achurch, Ltd.
Parkinson Stove Co., Ltd.
Parkinson & W. & B. Cowan, Ltd.
Ransomes, Sims & Jefferies, Ltd.
Smalls, Ltd.
Star Vacuum Cleaner Co.
Streetly Manufacturing Co., Ltd.
Sutherland Meter Co., Ltd.
Swingler, G. & S., Ltd.
Taylor & Challen, Ltd.
Victory Valves, Ltd.
Whitehouse, W., & Co., Ltd.
Wild-Barfield Electric Furnaces, Ltd.

The advance catalogue of the Birmingham Section is, as usual, a trade directory as well as a guide. Brief particulars of each exhibitor's display are given, together with postal and telegraphic addresses, telephone numbers, &c. A comprehensive index in which the exhibits are classified by products appears at the end, and this is repeated in French and Spanish.

The London Section.

The Department of Overseas Trade, which is responsible for the organisation of the London Section of the Fair, has sent us a catalogue of the exhibitors at Olympia. This catalogue gives the names in alphabetical order with a brief summary of each manufacturer's products. At the end is a very excellent classified index in nine languages. The catalogue is being issued immediately to 10,000 business men in Europe, North America, South Africa, and the eastern coast of South America. From the thousand names in the list we have selected the following as exhibitors of goods of an electrical or allied character :—

Accurate Recording Instrument Co., Ltd.
Albion Shades, Ltd.
"Attracta" Electrical Co.
Bakelite, Ltd.
Beetle Products Co., Ltd.
British Acoustic Co.
Bruette.
Burovox, Ltd.
Calvete, I., Ltd.
Cambridge Instrument Co., Ltd.
Celebrity Gramophones, Ltd.
Cole, E. K., Ltd.
Continuous Gramophones, Ltd.
Cook's Wireless Co., Ltd.
Digby, Thomas J., Illuminating Engineering Co., Ltd.
Dowsing Radiant Heat Co., Ltd.
Eastick, J. J., & Sons.
Edison Bell, Ltd.
Electric Art Shades (1928), Ltd.
Ever-Ready Co. (Great Britain), Ltd.
Federation of British Industries.
Formo Company.
Goodworks, Ltd.
Hailwood & Ackroyd, Ltd.
Halcyon Wireless Co., Ltd.
Ideal Home Electrical Appliances, Ltd.
Igranic Electric Co., Ltd.
Imperial & International Communications, Ltd.
"Indurite" Agency.
Itonia Gramophones, Ltd.
Johnson, Matthey & Co., Ltd.
K.F.M. Engineering Co., Ltd.
Lever, Eric J. (Trix.), Ltd.
Lissen, Ltd.
M-L Magneto Syndicate, Ltd.
Marco Refrigerators (1929), Ltd.
Neophone Engineering Co.
Newton, J. M., Vitreo-Colloid (1928), Ltd.
Nobbs, George, Ltd.
Ormond Engineering Co., Ltd.
Parks, F., Ltd.
Peerless Electrical Manufacturing Co., Ltd.
Read Radio, Ltd.
Rees-Mace Manufacturing Co., Ltd.
Ross, Ltd.
Staines Kitchen Equipment Co., Ltd.
Thermega, Ltd.
Waverley Wireless Co.
Whittingham, Smith & Co.

Proposed New Egyptian Tariff.

Duties on Electrical Apparatus.

THE *Board of Trade Journal* for January 2nd publishes extracts from the new Customs tariff which the Egyptian Government proposes to put into force on February 17th next. A complete translation of the proposed tariff law and the new tariffs were to be published as a special section of the January 9th *Journal*. In the extracts the duties on electrical machinery and apparatus are set out as follows :

	Millièmes.
Chapter 73.—Electric machines and apparatus and articles for electro-technical use, and detached parts thereof.	
777 Electric generators, electric motors and transformers, weighing :—	Per 100 kg. net.
(*a*) 1,000 kg. and over	800
(*b*) From 50 kg. inclusive to 1,000 kg. exclusive	1,200
(*c*) From 10 kg. inclusive to 50 kg. exclusive	1,800
(*d*) Less than 10 kg.	3,000
778 Electric locomotives	400
779 Electric batteries and their component parts	12% *ad val.*
780 Electric accumulators and their component parts	Per 100 kg. net. 1,800
781 Magnetos and sparking apparatus for explosion motors	Per kg. net. 120
782 Electric fans	12% *ad val.*
783 Electric arc lamps, and metal components parts	Per kg. net.* 50
784 Electric lamps and valves :	
(*a*) For wireless	300
(*b*) Other	150
785 Telegraphic and telephonic apparatus of all kinds, including wireless telephone and wireless telegraph apparatus	12% *ad val.*
786 Electric signalling and safety apparatus for railway and other purposes	10% *ad val.*
787 Electro-medical apparatus, including that used for dentistry	8% *ad val.*
788 Electric heating apparatus, electric and electro-technical apparatus for domestic use :	
(*a*) Irons, and detached parts thereof	15% *ad val.*
(*b*) Other	15% *ad val.*
789 Insulated wire and cables for electricity :	Per 100 kg. net.
(*a*) Submarine and underground cables	500
	Per kg. net.
(*b*) Other	15
790 Parts and articles of carbon, agglomerated or baked, for electrical use	45
791 Parts, mainly for electrical use, made of insulating materials, not specially mentioned in the tariff :	
(*a*) Of porcelain, earthenware, baked clay, stoneware, glass and the like§ :	
(1) Weighing 100 grms. or more each	5
(2) Weighing less than 100 grms. each	12
(*b*) Of asbestos and asbestos board, stabilite, mica, micanite, meglionite, ambroine, bakelite, rubber, ebonite, vulcanised fibre, galalith and other similar materials, without parts of metal or other materials†	35
(*c*) Insulating tubes, and joints and junction boxes for insulating tubes :	
(1) Without metallic covering ...	45
(2) Other	12
792 Electrical and electro-technical apparatus, parts or detached pieces of electrical or electro-technical apparatus, of dynamo-electric machines and for the application of electricity, not elsewhere specified, of any weight	10% *ad val.*

* Including the weight of the paper and cardboard forming the immediate wrapping.

† Articles of this kind combined with parts of metal or other materials fall under No. 792.

1,000 millièmes = £E1 = 20s. 6d.

In a note relating to the above, it is stated that, as a general rule, the importer must furnish a declaration giving the name, weight, and nature of the parts of which the machine is made, as well as a plan or drawing of the machine. In all goods where electrical material is imported with any other material, the electrical material is always liable separately to its proper duty.

American Industry at Home and Abroad.

Electrical Manufacturers' Survey: Branch Factories in Foreign Countries.

A STATEMENT which we have received from the National Electrical Manufacturers' Association of the United States indicates that during 1928 improvements in production occurred in all divisions of the Association which is concerned with all electrical goods with the exception of large central station apparatus and power generating equipment in general, motors above 200 h.p., lamps and certain radio manufactures. At the same time most manufacturers anticipate a decline during the first half of the current year. A review of the position was recently made by Mr. Clarence L. Collens, president of the N.E.M.A., who said :—

"As a whole the electrical manufacturing industry has enjoyed real prosperity during 1929. In many branches the activity has been considerably above normal and in all above the levels of 1928. . . . The anticipation for the first six months of 1930, except possibly in radio, is a return to normal activity but at levels which will be in step with the steady continued growth of all industrial activity in this country. Our programme for the year 1930 should be directed towards: (1) the maintenance of normal activity; (2) the extension of all research investigations; and (3) the modernisation of industry. . . . Research should not be limited to the scientific investigation of materials and the development of new products, machines, and methods, but should extend into the realm of the facts and economics affecting our industry, more accurate information regarding the current business situation, its trends and inventories and some investigation of the costs and channels of distribution. The year 1930 with its return to more normal conditions backed up by the funds available from the prosperity of 1929, affords a real opportunity for effective work in the modernisation of industry. There are still too many obsolete, inefficient machines and methods in all industry. We must set our own house in order but can also do constructive educational work in other industries. This means extension of modern industrial lighting, greater use of electric heat and electric welding in manufacturing processes, the introduction of modern efficient machinery properly motorised to give improved quality and lower costs, and more labour-saving machinery in the flow and handling of all materials. An effective programme of research and modernisation in industry motivated by the slogan—WORK—will not only promote normal business in all electrical lines during 1930, but will lay an important foundation for future prosperity."

Confidence in the fundamentally sound condition of American industry, despite the recent stock market troubles, is indicated by the expansion programmes to be embarked upon this year by some of the leading United States public utility concerns, whose activities are generally regarded as an index of industrial prosperity as a whole. According to official reports from New York, the largest supplier of electric light and power under single control in America, the North American Company, has announced a construction budget for 1930 involving the expenditure of $57,000,000 (£11,400,000).

American Branch Factories Abroad.

In a recent issue of *Commerce Reports*, the subject of the establishment of branch factories in foreign countries by American manufacturers is thoroughly and interestingly discussed by Mr. Louis Domeratzky, Chief of the Division of Regional Information of the U.S. Bureau of Foreign and Domestic Commerce. In a study of the reasons which lead to the decision to establish such factories, the author shows that mass production methods in the United States have necessitated the finding of foreign markets for surplus products. It is pointed out that the setting up of works in foreign countries did not originate with the United States; several European countries, particularly Great Britain and Germany, had already successfully followed this course. Even in the United States some of the most important rayon (artificial silk) factories are controlled by British capital, with German concerns next in importance.

In many instances the establishment of a works in an important market gives a positive stimulus to the sale of the product, but in many other cases the reason lies in the necessity for overcoming certain natural or artificial obstacles. The transport problem is of importance in the case of heavy plant but does not seriously affect smaller products. The manufacture of an article within a country may be the means of reducing the price to the public, leading to increased sales. It may be necessary to avoid heavy tariffs, or often to overcome national prejudice. In connection with tariffs it is pointed out that no advantage would accrue if it was proposed to supply outside the borders of the country in which the factory is established. The British Empire provides an exception to this rule; in this case the entire market can be supplied advantageously, from a tariff standpoint, from a plant established in any Dominion or colony enjoying preferential treatment. Many American factories have been erected in Canada for this reason. Other factors which enter into the subject are patent conditions and "servicing."

One interesting passage of the article is reproduced below :—

"As a corollary of the general tendency toward economic nationalism, we find the growing appreciation of the economic importance of the colonial markets and an effort to strengthen the feeling of solidarity in the British Empire, intensified to a considerable extent by the post-war economic difficulties of the mother country. All these tendencies naturally have a direct bearing on international trade; in so far as they serve to create a national sentiment against dependence on foreign countries for the supply of certain products, they furnish an inducement for the foreign industries interested, say, in the British market to establish separate plants—in most cases controlled by the parent plants, but frequently with a predominant British personnel and some of the other outward characteristics of a British plant. In the case of some of the British dominions there is in addition the strong pull exerted by a pioneer country trying to diversify its economic life by the addition of manufacturing industries, with or without a basis of domestic raw material."

Indian Electrical Imports.

Statistics for the first half of 1929-30.

THE British Trade Commissioner at Calcutta (Mr. D. Montgomery Clarke) has prepared for the Department of Overseas Trade a survey of the import trade of India for the first six months of the fiscal year 1929-30—from April 1st to September 30th, 1929. This shows that with regard to the import trade generally there was a decrease in the total of 0.1 per cent., as compared with the corresponding period of 1928.

The imports of electrical machinery and electrical apparatus, however, showed satisfactory increases, the former from Rs. 108 lakhs to Rs. 124½ lakhs, and the latter from Rs. 147 lakhs to Rs. 172 lakhs. Great Britain's share of the electrical machinery trade advanced from Rs. 83 lakhs to Rs. 92¼ lakhs. Imports from Germany rose from Rs. 6¾ lakhs to Rs. 8¾ lakhs, while the share of the United States fell from Rs. 13¾ lakhs to Rs. 12¾ lakhs. Imports from other countries, not shown separately, increased from Rs. 4½ lakhs to Rs. 11 lakhs.

All the supplying countries shared in the increased imports of electrical instruments and apparatus, including telegraph and telephone apparatus. The British share rose from Rs. 94¼ lakhs to Rs. 103 lakhs, that of Germany from Rs. 14¼ lakhs to Rs. 20½ lakhs, Holland from Rs. 7¼ lakhs to Rs. 9½ lakhs, Italy from Rs. 6 lakhs to Rs. 7¼ lakhs, Japan from Rs. 2½ lakhs to Rs. 3½ lakhs, and America from Rs. 16¾ lakhs to Rs. 21¼ lakhs.

Of the total the imports of electric fans and parts thereof accounted for Rs. 21½ lakhs, of which the British share was Rs. 10¾ lakhs, and that of Italy Rs. 6¼ lakhs. In electric wires and cables (rubber insulated), out of a total import of Rs. 22 lakhs, the British share advanced slightly to Rs. 18¾ lakhs, and this country was the principal supplier. Again, in cables with insulation other than rubber, out of a total import of Rs. 20½ lakhs, the British share was Rs. 18½ lakhs. Imports of electrolytic bare copper wire (other than telegraph and telephone wires) amounted to Rs. 11¾ lakhs, of which the British share declined slightly to Rs. 8¾ lakhs. Shipments from Holland advanced from Rs. 48,000 to Rs. 1¼ lakhs. The total imports of electric wires and cables amounted to Rs. 54¾ lakhs, of which the British share advanced to Rs. 46½ lakhs, and those of Germany and Holland to Rs. 3 lakhs and Rs. 2¼ lakhs, respectively. Of the imports of telegraph and telephone instruments and apparatus amounting to Rs. 2¾ lakhs, the British share declined slightly to Rs. 2¼ lakhs. The imports of standard lighting lamps amounted to Rs. 13 lakhs, of which the British share was Rs. 4 lakhs and that of Holland Rs. 5¼ lakhs. Of the imports of electrical accumulators (including parts) amounting to Rs. 9¾ lakhs, the British share declined from Rs. 7¼ lakhs to Rs. 6¾ lakhs, while imports from America advanced from Rs. 76,000 to Rs. 1¼ lakhs. The trade in electric lighting accessories and fittings (including switches), amounted to Rs. 8¾ lakhs, of which the British share declined slightly to Rs. 5 lakhs, while that of Germany and America advanced slightly to Rs. 1¾ lakhs and Rs. 71,600, respectively. The trade in electric meters is still largely held by the United Kingdom, who share was Rs. 4 lakhs out of a total of Rs. 5 lakhs, the balance being divided between Germany, Rs. 44,000, and other countries, Rs. 56,600. Electro-medical apparatus (including X-ray apparatus) amounted to Rs. 2¼ lakhs, of which the principal supplier was America, with shipments valued at Rs. 1¼ lakhs, while the British share amounted to Rs. 62,000. In the imports of electrical goods and apparatus (not enumerated) amounting to Rs. 25½ lakhs, the British share advanced from Rs. 14 lakhs to Rs. 18 lakhs, while Germany, Japan, and America all showed slightly reduced shipments valued at Rs. 3¼ lakhs, Rs. 52,500, and Rs. 3 lakhs, respectively.

The imports of radio apparatus declined from Rs. 7½ lakhs to Rs. 3½ lakhs, the British share falling from Rs. 5½ lakhs to Rs. 2 lakhs. Imports from Germany, Holland, France, and the United States were all under the value of Rs. 50,000.

Lighting in Historic Buildings.

Some notes on the recently completed installation in the Bodleian Library, Oxford, in which "Holophane" units are used throughout.

THE oldest part of the Bodleian Library, Oxford, was built between 1450 and 1480, and it contained the MSS. given to the University by Humphrey, Duke of Gloucester, which were dispersed and destroyed in 1550 by the Commissioners of Edward VI. In 1598, Sir Thomas Bodley determined to furnish again Duke Humphrey's room with cases and books, and so became the founder of the Bodleian Library. In 1602 the Library was formally opened with over 2,000 volumes, of which 299 were MSS. Ten years later the Arts End was added, and between 1613 and 1618 the third storey of the Quadrangle was built with money provided for the purpose by Sir Thomas Bodley. This upper portion is now occupied by two reading rooms and the picture gallery. In 1640 a room was built at the west end of Duke Humphrey's Library, now called the Selden End. These three rooms and the third storey were sufficient for the purposes of the Library until 1790, when it began its encroachment on the various rooms and schools of what is now the Bodleian Quadrangle.

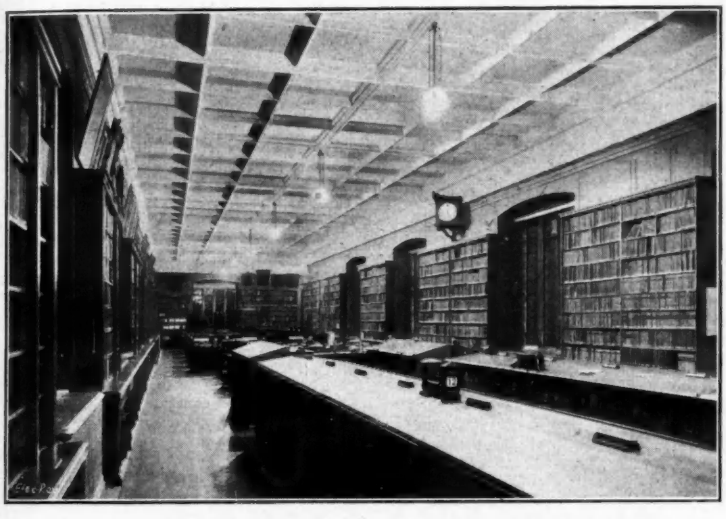


Fig. 1.—General Lighting Effect in the Bodleian Library.

For over three hundred years from its foundation in 1602 no artificial light of any kind was allowed to be introduced into the library, but in 1913 the use of electric torch-lamps was permitted for staff purposes. On account of this lack of artificial lighting, it was necessary in winter to close the reading-rooms at 3 p.m., which had always been a great inconvenience to scholars. The proposal to install electric lighting in the Bodleian building was brought forward in 1926 and finally approved in the summer of 1929. The contents of the Bodleian Library being of priceless value, quite irreplaceable and uninsurable, the most important point was to make the electrical installation perfectly safe, and also to convince the jealous guardians of this magnificent library that such could be done. A scheme has been devised by which no flexible cords are used. The highest quality electric lighting wires enclosed in steel tubing are used, and are conveyed to every lampholder, whether it be a portable fitting, pendant or other similar device. All the switches, lampholders and fittings of all descriptions are metallically and electrically connected to the conduit, and the whole system is carefully earthed at many points, so that in the event of any improbable damage to an insulated wire, the only effect would be that the fuse protecting that circuit would "blow" and cut off the circuit from the supply until it was repaired. Under this system there is no possible chance of fire. This system has been carried out throughout the reading rooms and the picture gallery, and very little conduit is visible, in spite of the fact that no walls have been chased and no tubing sunk or hidden anywhere except under the floorboards.

In the upper reading room and picture gallery, which are full of readers' desks and catalogue stands, as well as bookcases, two schemes were proposed:—

(1) To light each individual reader's desk strongly, and to provide a low general illumination.

(2) To provide a general illumination of high intensity, and no local illumination at all.

After discussion it was decided that the latter arrangement was best, as it permitted the re-arrangement of the desks, catalogue stands or bookcases without any alteration to the electric wiring. After experimenting with many types of fittings, it was found that the "Holophane" reflector refractor fitting was the most suitable, not only from an illuminating point of view, but also from an artistic consideration, and each of these rooms, which are 172 ft. long and 26 ft. wide, is illuminated with nine reflector refractor units with 300-watt lamps. The illumination from these is approximately 7 foot-candles over the whole of the table surfaces throughout the two galleries. These fittings are unobtrusive by daylight, and the shape of the glassware and lines of the four supporting chains blend with the architectural features of the room. Each light is controlled by its own switch, the switches being grouped at the fuseboards and under the control of the janitor. One special feature of these fittings is that the circuit wires are continued down to the lampholder from the junction box in the ceiling, and are protected by a flexible metallic tube which is metallically connected both to the conduit and to the lampholder.

In the older part of the building, the Duke Humphrey's Library, with the Arts and Selden ends, is treated in an entirely different manner. Here the ceiling is painted, and of great beauty. It was, therefore, decided that no work was to be done on the ceiling at all. At the same time its beauty required it to be shown up at night by illumination. The final design evolved was to put standards with wooden columns and heavily frosted enclosed bowls upon the tops of the projecting bookcases in the Duke Humphrey's Library, and on the tops of the gallery rails at the two ends. The effect is very beautiful, the ceiling being lightly illuminated, and the floor area and bookcases also receiving a moderate general illumination. This illumination, however, is not sufficient for the readers; therefore, in each alcove in the Duke Humphrey's Library, short brackets are clipped to the book-

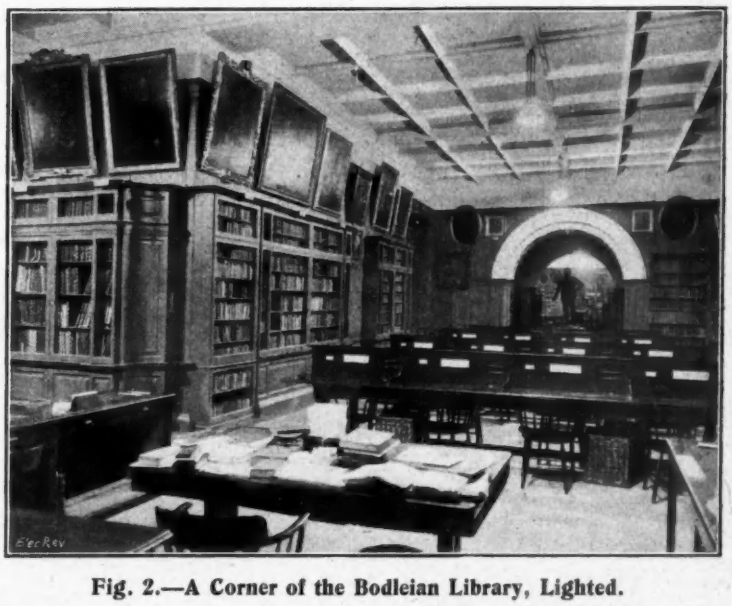


Fig. 2.—A Corner of the Bodleian Library, Lighted.

shelves, with metallic reflectors, and certain of the desks in other parts of the Old Reading Room have standards, also with metal reflectors, thus the readers' desks and the staff desks are brightly illuminated, without the light straying from these lamps to the upper part of the Library and spoiling the general ilumination by strongly marked lines of shadow. The book-cases under the galleries are illuminated by a number of lamps with metal shades hidden under the mouldings. In every case the circuit wires are taken direct into the lamp-holder, and each lampholder is connected metallically to the conduit.

The illumination and electrical specifications for this most interesting installation were prepared by Messrs. Dolby and Williamson, consulting engineers, whilst the entire electrical work has been carried out by Messrs. Hill, Upton & Co., local contractors.

An All-electric School.

Some Notes on the Equipment at Dundee's new Educational Centre.

ELECTRICITY as an aid in educational work is undoubtedly being more widely recognised and exploited every year, and new schools which have been built during the past few years have at least electric lighting as one of their main features.

The Logie Central Advanced Division School, which has just been completed and was recently opened by the Rt. Hon. W. Adamson, Secretary of State for Scotland, is a unique example of a school in which every advantage has been taken of electrical resources. The school is situated in the north-west of Dundee, occupies a site of about five acres, and comprises 28 class rooms with a total capacity for 1,050 pupils. In addition to the ordinary class rooms, there are three large senior science rooms or laboratories, a lecture room, two woodwork shops, an engineering shop, and a smith's shop. These training rooms for manual labour are equipped exceptionally well with machine tools, which comprise wood-turning lathes, a metal hack saw, a grinder, 6-in. and 3½-in. turning lathes, a vertical drill and buffing machine, a smith's hearth, and an annealing furnace and brazing hearth. All the machines are fitted with individual motors for independent drives, and, as a safety factor, push-button controls for emergency purposes are fitted at various points in the engineering shop.

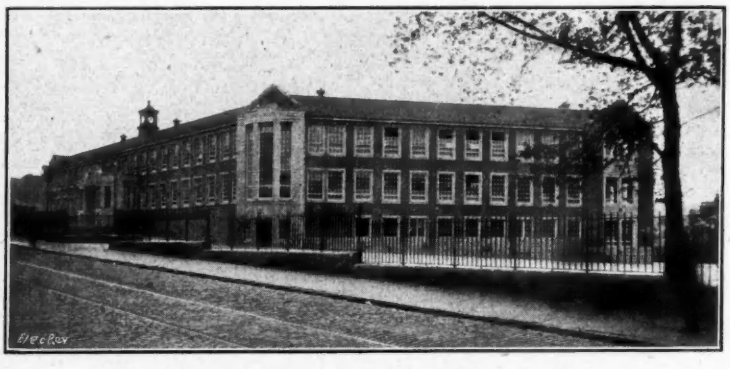


Fig. 1.—Logie Central Advanced Division School, Dundee.

An important educational feature in the girls' section is the laundry, which is fitted with 20 wash tubs (each supplied with hot and cold water) and ironing tables. There is accommodation for 20 pupils, each of whom is allotted an electric iron. In connection with the installation in the laundry, it was considered advisable to transform the current down to 100 V, and, in addition to the plug and switch fitted for each of the 20 pupils, a switch is provided on each iron connector. The two sewing-class rooms, to which current is supplied at 100 V from the same transformer, are equipped with pressing irons and two plugs with independent switches. The top floor, which has a north-eastern aspect, is occupied by two art rooms, each of which is complete with individual drawing desks and easels. These important rooms are lighted by individual lights which are adjustable for correct height and angle, and are controlled by longitudinal wire guides on which pulleys run.

Between the boys' section on the west and the girls' section on the east is the hall, 88 ft. by 48 ft., occupying a central position, forming a gymnasium divided in the centre by a sliding partition, and equipped with a kinematograph and stage. The lighting consists of twenty 300-watt enclosed units, arranged for lowering from the hall attic for cleaning and renewal. The stage is provided with plugs and switches for the setting up of footlights. The seating accommodation of this central hall is 950, inclusive of the balcony.

To left and right of the main entrance are separate entrances for boys and girls, the administrative departments, the headmaster's rooms and janitor's office. The main entrance hall is finished in wood panelling and "Terrazo," and when lighted by its seven 100-watt enclosed units, it offers a truly impressive decorative effect. Housed in the janitor's office are the main five-panel ironclad switchboards; one 346-V controlling the motors, kinema, and transformer; one 200-V controlling the small power circuits; and three 200-V controlling the lighting. The main control clock is also installed here, together with the automatic bell control, which is so arranged that in the event of disorganisation of the automatic control, the bells for assembling, dismissing or changing classes can be rung by unit switches by the simple operation of the change-over switch. Fig. 1 is a general view of the school, and fig. 2 shows the inside of the metal workshop. The supply is a.c., 3-phase, 4-wire, 50 cycles, 346 V across phases.

The whole of the cable used for the installation, over 25,000 yards altogether, is of Henley's manufacture, the bulk of it being Class "A." In addition, over 800 yards of Henley's flexible cords were used. The whole of the electrical work in these up-to-date school buildings, which are of artificial stone with rough cast between facings, was designed and carried out by Messrs. A. Westwood & Son, local contractors.

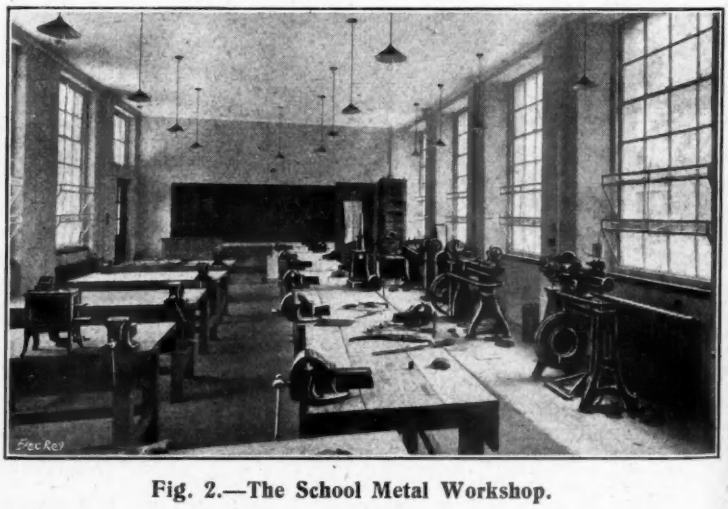


Fig. 2.—The School Metal Workshop.

The lighting throughout the school is made up of twenty 300-W, four hundred 100-W, and one hundred and eighty 60-W points, in addition to which there are twenty 5-A lighting sockets. The small power circuits comprise twelve 20-A sockets and switches for radiators, and twenty-four 100-V, 5-A, 3-pin sockets and switches for the laundry irons for the instructional use of the pupils.

The total cost of the school, exclusive of any furnishings, was £80,000, and the whole scheme was supervised and carried out under the control of Mr. R. A. Wilson, Clerk of Works, Dundee.

Electricity and Gas in Germany.*

A Comparison of Costs Based on Everyday Use in the Household.

(*Concluded from page* 39.)

II. *Kitchens with separate water heaters, either for kitchen water only, or for kitchen and bathroom.*

The amount of hot water used in any household depends not only on the general habits of the family and the skill of the cook, but also very decidedly on the kind of apparatus used for supplying the hot water. In general it may be taken that the more convenient the arrangement the greater will

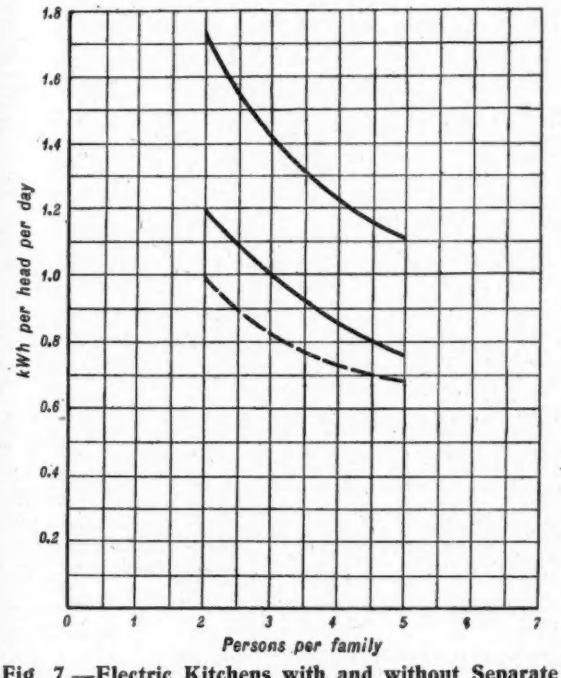


Fig. 7.—Electric Kitchens with and without Separate Water Heaters.

be the quantity of water used. Thus, when each kettle of water has to be separately heated on the ordinary cooker the cook and everyone else in the house is likely to be very economical in its use, whilst the same family, as soon as a quick source of hot water is available, is quite liable to be converted to a lavish if not a wasteful user of hot water. Just because of its great convenience electric hot water apparatus generally leads to an abnormal amount of hot water being used—not only for cooking and washing up but for the most varied household cleansing purposes. It has been found that households which previously used about ½ to 1 gallon per head per day quickly increased this to 1½ to 2½ gallons per head per day, after a separate electric water heater had been installed.

If, on the other hand, a gas geyser has been installed,

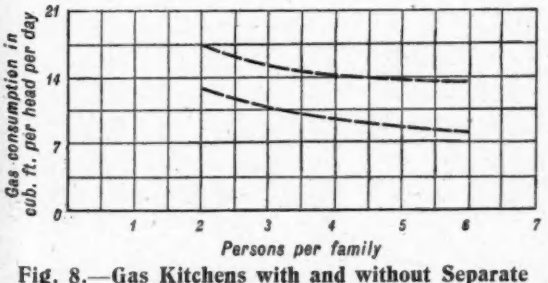


Fig. 8.—Gas Kitchens with and without Separate Electric Water Heaters.

which needs re-lighting each time hot water is wanted (a by-pass flame uses 150-180 cu. ft. per month and is, therefore, not often fitted) the housewife thinks twice before using it, and often prefers to use a kettle or pan on the open gas burner. Consequently, a good deal more water is likely to be heated in the electric house than in the gas house.

When the water heater is also used for baths, further diversities are introduced by the varying views on hygiene held by different families. Again, when several hot water taps are provided in different parts of the house, the losses from pipes may influence the total consumption considerably.

Table IV shows the volume of water required to fill 1 ft. run of piping of various gauges:—

TABLE IV.

Diameter of pipe ...	¼ in.	⅜ in.	½ in.	1 in.
Gallons of water per ft. run of pipe	.0021	.0048	.0084	.0336
Gallons of water per ft. run if filled 20 times	.042	.096	.168	.672

As an example take the case of a 17½ gallon water heater installed in the bath room and connected by 16 ft. of ½ in. pipe to a tap in the kitchen. If this tap is used some 15 or 20 times a day it will take 2 to 2½ gallons a day or 12 per cent. of the total heater capacity merely to supply the piping. It is, therefore, of some importance to keep such taps as close as possible to the water heater—especially if frequent small quantities are to be drawn from them. Separate heaters for bath and kitchen are often desirable from this point of view, in spite of the higher capital cost.

When water heating by gas geyser is considered, an additional serious source of loss is at once apparent, *viz.*, that due to the hot water left in the internal spaces (heating spirals, &c.), after each occasion that the geyser is used. In a small

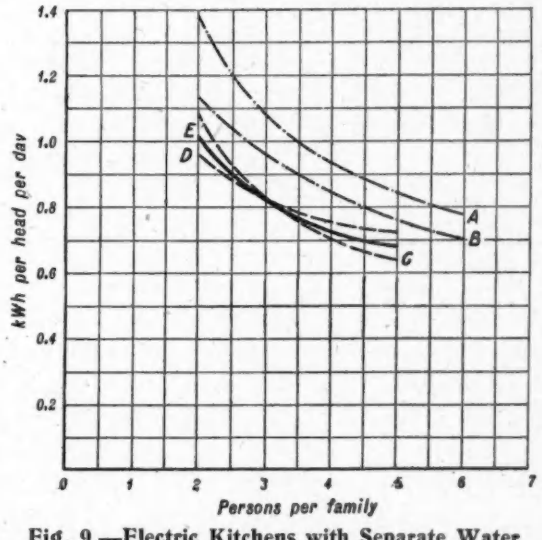


Fig. 9.—Electric Kitchens with Separate Water Heater.

kitchen geyser these internal spaces may amount to ½ gallon, whilst in a large bathroom geyser they may hold 2—2½ gallons.

This volume of water cools down rapidly after the geyser is shut off since no special heat insulation is provided. Consequently, at any rate in kitchen use, the whole of the heat is wasted. Suppose a kitchen uses 7 gallons of hot water a day and draws this off in the form of 15 separate quantities (a very moderate estimate). This will mean that something like 7 gallons, or an amount equal to the useful water, will be wasted in the course of a day. Even then no account has been taken of the additional waste heat, resulting from the partially heated water which has to be run through the geyser each time it is used before the necessary water temperature is attained.

Efficiency tests based on a continuous flow of hot water are, therefore, no guide to the actual gas consumption in actual kitchen use. With electric water heaters built on the heat storage principle and provided with good heat insulation, the efficiency is much less affected by the way in which the water is used, *i.e.*, whether a large quantity is drawn off at one time, or frequent demands for small quantities are made.

Electric kitchens with separate water heater: (*a*) *consumption for cooking only.* Fig. 9 gives a number of Swiss and German results collected for this type of kitchen.

Curve A represents Härry's results from 550 households in the canton of Zürich of middle-class farming and industrial standing.

Curve B gives results collected by Locker from 100 houses

*Abstract of a paper by Dr. F. H. Mueller and Herr F. Mortzsch in "Elektrizitütswirtschaft," 1929.

in the city of Zürich, occupied by middle-class town dwellers These curves do not include the lighting consumption but do include that for portable apparatus, such as would be connected to the socket fitted on the cooker.

Curve C has been collected from a large number of German electricity supply companies.

Curve D gives some recently published figures for 100 families in 4-roomed houses in Römerstadt near Frankfort-a-M.

Curve E represents the average of C and D and may be taken as the mean value for German houses of this type, in which a separate water heater is provided. Curves C, D and E refer to purely cooking consumption and exclude both lighting and portable apparatus. The cookers were all of the hotplate type.

The values read off curve E are: kWh per head per day 1, .82, .73 and .68 for families of 2, 3, 4 and 5 persons respectively.

It will be seen that the Swiss figures are some 20 per cent. higher, and this is accounted for partly by the lower price of current in Switerland and partly by the consumption in the portable apparatus included in the Swiss totals.

(*b*) *Consumption for water heating.* In considering the consumption of hot water a sharp distinction must be drawn between cases where the water is only required for kitchen and household cleansing and cases where, in addition, it is required for baths. Not many figures are available for the former of these two cases, but the authors have collected what figures they could obtain from the German electricity supply authorities with the following results: kWh consumption for kitchen hot water per head per day .75, .6, .5, .43 for families of 2, 3, 4 and 5 persons respectively.

Results for the second case (kitchen and bathroom hot water) are even scarcer, but, as a rough guide, some figures obtained from the Römerstadt 4-roomed dwellings may be given: kWh consumption for kitchen and bathroom hot water, 2.25, 1.55, 1.3 and 1.08 for families of 2, 3, 4 and 5 persons respectively.

Similar figures for Zürich (collected by Locker) are: 2.07. 1.59, 1.3 and 1.15 kWh per head per day for families of 2, 3, 4 and 5 persons respectively.

These consumptions are probably on the high side, as the arrangement was not the most efficient in either of the cases. In Römerstadt a 17½ gallon storage heater was fitted in the bathroom and taps were provided both in the kitchen and for a basin in the bathroom. In the Zürich houses the arrangement was similar but the heater capacity was 22 gallons.

It is interesting to compare the total consumptions in kitchens with and without separate water heaters. This is done in fig. 7 for German households.

The lowest (dotted) curve represents the consumption for cooking alone in houses possessing a separate storage water heater. The middle curve shows the total consumption in kitchens without any separate water heater, and the upper curve shows the total consumption for cooking and hot water when a separate storage water heater is provided.

It must be remembered that the large increase in consumption in the last case does not represent a corresponding increase in cost because the storage water heaters obtain their energy at the specially low night-time charge. At the same time the increased consumption represents a great increase in convenience, as the housewife has a constant supply of hot water (80 deg. C.) at her disposal.

2. *Gas kitchens.* No reliable figures are available for the separate consumption of gas for cooking and for hot water preparation, but Härry has again provided some valuable results on the subject. His figures deal with 436 households in Zürich in which cooking was done by gas, and a separate electric storage heater was provided for the kitchen hot water. The results (reduced to standard German gas of 3,500 kg. calories per cubic metre) are as follows: Gas consumption for cooking in cu. ft. per head per day, 13, 10.9, 9.5, 8.7 and 8.2 for families of 2, 3, 4, 5 and 6 persons respectively. These figures, together with the higher curve for gas consumption, when no separate heater is provided (reproduced from fig. 2), are shown in fig. 8.

No similar figures, with water heating by gas, are at present available so that no useful comparative figures can be deduced. It is certainly unlikely that as much reduction in gas consumption for cooking (some 20—25 per cent.) would occur if the electric storage water heaters had been replaced by gas geysers, owing to the reduced efficiency of the latter when used for small quantities of water as explained above.

The article concludes with a destructive criticism of some comparative figures between gas and electric consumption recently published in Germany, which unduly favour the former. As the authors point out, even if it could be shown that the cost of cooking by electricity were a fraction more than gas, this would be immaterial. The determining factor is the housewife's view of the question, and she is already well on the way to settling the matter in favour of electricity on the score of convenience.

The Overhead Lines Association.

British and Continental Methods Compared.

AT the last meeting of the Association in London last month, Mr. THEODORE STEVENS (president) occupied the chair, when Major THEODORE RICH (hon. secretary) gave an account of methods of overhead-line construction and electricity supply on the Continent of Europe.

He pointed out that almost from the start electricity was recognised on the Continent as a public utility, not merely something to obstruct and tax, and claimed as a consequence that Continental engineers were the first to tackle power transmission worthy of the name, and were also the first to handle rural electrification. British engineers, however, were pioneers in generation, and reference was made to the many works carried out on the Continent by Messrs. Crompton. until they were boycotted by financiers at home and pushed out by tariffs. The essence of Continental transmission had been water power, and the essence of rural electrification had been low capital costs and wayleave facilities. In England progress was held up owing to the existence of internationally-held three-phase patents arranged in such a way as to keep British engineers out of the power-transmission machinery and contracting markets of the world.

Most countries now used a frequency of 50 cycles. For distribution 110 to 125 volts was still usual in France, Spain, Italy, and Switzerland, but Germany was changing to 220 V, and so were the new rural areas in France. The influence of super-stations on the Continent, except in the lignite areas around Cologne and Leipzig, had been insignificant, and where large-scale transmission had taken place it had primarily been from water-power and lignite-power sites.

For transmission up to 150,000 volts, spans had not exceeded 200 metres; moreover, a large proportion of the towers were slender, the assumption being that in case of a line breakage a simple hanger would slip and thus the strains to be allowed for were limited. Concrete "centrifugal" posts had been used, especially in Germany, for 50,000- and 60,000-volt lines, in Italy for 130,000-volts and a new line for 240,000 volts, and recently in France for 90,000 volts. Elaborate differential trip gear with pilots was not often used and things did not seem to be much the worse. In Scandinavia, Poland, and Italy the system of two uprights and a cross bar had had some vogue for very high voltages. As regarded transmission-line protection, lightning-discharge gear was out of favour and, although earthed wires above the lines were looked upon as a valuable help, it is recognised that one could protect a line against a direct hit. Pin insulators were used for higher voltages than in this country, a number of recent lines at 60,000 volts having them, but chain insulators were being used for lower voltages. The cap type of chain insulator seemed to be more popular than the Hewlett, the extra safety of which, remarked Major Rich, had proved to be somewhat elusive. Glass insulators had made extraordinary progress in France and to a lesser extent in Italy, and in France, as compared with porcelain, the output was said to be 4 or 6 to 1. Glass, however, had not taken on for suspension work.

There was still much controversy on the Continent regarding the earthing of h.v. neutrals, and it was not so usual in Germany as in other countries. According to theory, if a conductor were carrying a substantial alternating current and surrounded by a closed circuit, eddy currents would circulate in it, but he had been told by a transmission-line engineer on the Continent that that had not been found to be the case. As a matter of fact, there were quite a number of transmission lines on the Continent which were guarded in such a way as to be complete metallic circuits and, although he could not quite ascertain the reason for doing it, he had been informed that no extra losses had been traced.

One of the advantages favouring transmission lines on the Continent, continued Major Rich, was the existence of many wide roads, sometimes for stretches of 20 miles, originally made for military purposes, alongside which transmission lines were run. People were not afraid of roadside lines on the Continent, and nowhere was it necessary to use double insulators for roadside running. Concrete posts had gone ahead rapidly for high voltages, especially in France, and for medium transmission voltages in Germany, Austria, Spain, and Italy; also, concrete bases were used largely to replace butts which had rotted, or to enable cheap local forest wood posts to be used. In some parts very light steel lattice posts were used for cross-country lines; from 10,000 to 16,000 volts seemed to be the favourite at the present time for h.v. distribution. There had

been trouble with aerial switchgear owing to shorts at contact insulators (some fatal accidents have occurred), and in France insulated pole-switch platforms had to be provided, according to the new regulations. Probably 75 per cent. of the mileage of distribution lines was alongside the roads. There were thousands of miles of roads on the Continent without hedges; tethered cattle were to be seen in many parts, and where there were rows of trees, there was usually space for transmission-line posts.

Brickwork, masonry, or concrete transformer stations held the field for a long time; pole-type transformers had come into considerable use for rural work recently, but they had not the vogue they had in America, one reason being that voltages were much higher. Rural distribution was in general on the open link system, controlled by fuses and aerial switches, usually operated under magnetising current only. Low-voltage porcelain outdoor link fuses were very common, whilst low-voltage distributors on insulators in front of the houses in villages and small towns were quite usual. Whilst many people had laughed at the systems to be found abroad, mainly at 110 volts, the fact was that without the greatest economy elecricity could never have become the poor man's light, as it had done here; electric lighting was very often cheaper there than here, because the capital charges were so much lower and the facilities greater. However, generally, improvements were going on. In Switzerland, for instance, power supply authorities must inspect house wiring. Reference was also made to the manner in which the use of portable motors was increasing, especially in France, whilst electric ploughing in France and Italy was specially mentioned.

Finally, commenting upon the cheapness of constructional methods on the Continent, compared with the position here, Major Rich said there was a tendency at home completely to reverse what used to be looked upon as sanity. A true engineer was a man who got the maximum satisfactory results with the least expenditure; whilst they could not always agree with what was being done abroad, a great deal of progress had been made which never could have taken place but for the study of what could be done without. It required no brains to spend money, but in electrical matters it required engineers worthy of the name to spend it properly.

Discussion.

Mr. R. BORLASE MATTHEWS said there was little doubt that a great deal could be learned by studying the methods of those who, like engineers on the Continent, had had a great deal of experience of overhead-line construction, and then endeavouring to go one better under the particular conditions in this country. Although, generally speaking, the climatic conditions on the Continent were different from those in this country, there were parts where the conditions were very similar, and in those cases there was a great deal to be said for analysing the methods adopted there and seeing to what extent they could be adapted for use in this country.

Mr A. H. SEABROOK expressed the view that the indictment running through the whole of the paper was that they in this country were the only people who could afford to waste money. It was a curious fact that those who had the misfortune to have to advise people on various electrical matters knew quite well that the more a man was made to spend, the more pleased he would be, and the whole tendency in this country was to make things as expensive as possible, so far as electrical work was concerned. Often expensive gadgets were added to systems, but they were usually out of use soon after they were installed.

Mr. W. P. GAUVAIN suggested that putting transformers in cabins on the ground instead of on the poles must increase the cost, although he agreed that a transformer on a pole was not a thing of beauty.

Mr. H. MOLLE said he could confirm from a period of residence in the Grenoble district what Major Rich had said about simplicity of construction. Notable features there were the use of concrete poles and glass insulators, and a very simple arrangement of distribution in the streets, the conductors being carried on iron brackets on the sides of houses. In one case the practice was adopted of digging a hole in the ground and placing the transformer in it with a fairly strong cover over it; the transformers kept cool under those conditions, and gave no trouble, but he did not know whether that practice was followed to any large extent now on the Continent.

Mr. W. FENNELL said that one thing that had appealed to him was the absence of stays for the poles. The pole lines seen from the train on the journey from Calais to Paris sent cold shudders down his back, because the poles stuck out at all angles, especially when going round curves, in order to get over the objection of the farmers to stays, because of the risk of shocks to cattle. There was also an entire absence of any earthing of the ironwork on poles, which also was quite usual in America where it was no uncommon thing to see poles alight. He had also seen some very interesting examples of bracket work in France, the brackets attached to the buildings carrying various power lines at different voltages and also telephone lines. He had some poles in the Mid-Cheshire area carrying lines at different voltages, but he had not yet succeeded in getting the Post Office to put its lines on the same poles. Again, in some of the slums of Paris distribution lines were carried over houses in a manner which gave a British engineer mental shocks. It was quite common to see them carried up the side of a tall building and then dropped down from the roof across a lower building on short pole lines, dropping down again, perhaps, 50 ft. on to another building, a kind of development of chimney-to-chimney distribution. A curious aspect of his visit was that, although those things struck him very forcibly when going out, they did not do so on the homeward journey, which rather suggested that it was easy to get used to them. At the same time he did not think it would be wise to adopt similar methods over here; to start, perhaps, too much on the safe side and modify in accordance with experience, was better than starting the other way round and developing upwards. For instance, there had been a modification of the Commissioners' Overhead-lines Regulations, and they were looking forward to another revision soon; they must not attempt to ride roughshod over the susceptibilities of the public in electrical development work and wayleaves. They must go to work quietly and slowly if we were to succeed in getting what was wanted. The tendency among go-a-head people with regard to rural electrification in this country, was to use pole transformers, and the number of rural undertakings that had built substations for rural work was very small. He differed from Mr. Matthews' suggestion that they should take what other people had done and then try and improve upon it; the trouble was that very often records only told of successes and not failures, and he had found it best on many occasions to work things out for himself. For instance, he had worked out the "open link" system without any knowledge of what was being done in France; he also had transformers on poles with switchgear underneath.

Mr. F. SWARBRICK asked if Mr. Fennell was correct in referring to pole transformers with the switchgear underneath, which seemed to him absolutely opposed to the security of the whole job. It meant that the main line must be disconnected before anybody could attend to the transformer.

Mr. W. FENNELL said it was necessary to get to the switchgear 90 or 95 times to every five times that it was necessary to get at the transformer, and the arrangement he had was such that the switchgear could be attended to with safety below the transformer and only when something required to be done to the latter was it necessary to shut the line down.

Mr. NAPIER PRENTICE suggested that lines laid alongside roads (on the Continent) for 20 miles in a straight run might not be an advantage, as long straight runs often introduced temperature difficulties; if there were a few angles things might be better in that respect. Further, long straight lines often introduced humming troubles, which were a nuisance to people living nearby. Lightning arresters were installed on a large installation in Italy for 25,000 volts, but he understood that in spite of the elaborate arrangements that had been made the arresters were practically out of use now.

Mr. L. STANTON suggested the possibility of the Overhead Lines Association formulating a sort of code, arising out of experience, of the best methods of overhead-line construction for various purposes. He maintained that it was possible to improve on both Continental and American practice and yet do the work cheaper. Regarding the use of guards round conductors on poles, eddy currents were insufficient to cause any effect, and he believed the idea was for lightning protection.

Major T. RICH, replying to the discussion, said that his whole object was to draw attention to the fact that there were very many overhead-lines on the Continent from which many people received supplies of electricity which they never would have received if the pole-line construction had not been exceedingly cheap. It was better that people living in small cottages in rural districts should have supplies, even if there was a slight risk of interruption owing to cheaper construction, than that they should have no supplies at all, because the regulations were too stringent.

Putting transformers in cabins did not increase the expense, as had been suggested, because in certain cases it was convenient to put other accessories in the cabin which would be very awkward on the pole, especially, for instance, when dealing with local lighting. Nevertheless, quite a number of pole transformers were in use. He maintained that it is worth while studying Continental methods and seeing to what extent they could be adopted here. He was a strong advocate of ferro-concrete posts, because the combination of steel and concrete prevented the collapse of poles in gales. In Italy and elsewhere on the Continent one often saw the switch on one pole and the transformer on the next pole with a simple interlocking arrangement, the line being cut off by an aerial switch before the transformer could be opened.

A Large High-Pressure Steam Plant.

We understand from *Power* that the Ford Motor Company has decided to install at its Rouge plant, U.S.A., a 110,000-kW turbine operating at 1,200 lb., which will be supplied by two boilers each capable of furnishing 700,000 lb. of steam per hour. These boilers will have the greatest steaming capacity of any boiler yet laid down for this pressure, and will be installed in practically the same sized casing as the older boilers of the plant, which have about one-third the capacity. The turbine unit is also the largest of this type yet built; the high-pressure element will be mounted on the low-pressure casing, and both generators will be of the same size and speed, one placed above the other. Steam will be supplied at 750 deg. F., and live steam reheaters will heat the steam between turbines. Four-stage extraction will be employed for feed-water heating, and economisers as well as air preheaters, will be used. The fuel will be blast-furnace gas and pulverised coal.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A Dentist's Lighting Fitting.

The accompanying illustration, fig. 1, depicts how the "B.A.G. Diffuser" of British B.A.G., Ltd., 23, Farringdon Avenue, E.C.4, has been adapted for use as a mobile and adjustable operating light for dentists. Perfect distribution of light and the dispersal of shadows are combined, it is claimed, with absolute freedom from glare. The standard is made of white-enamelled iron, and it can be easily wheeled on castors to any position in the room, while the arm bearing the diffuser

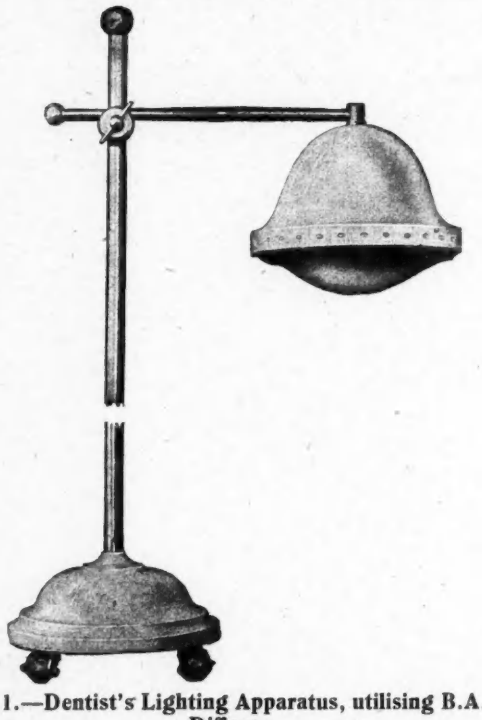


Fig. 1.—Dentist's Lighting Apparatus, utilising B.A.G. Diffuser.

can be easily raised or lowered to the desired height. "Daylight" glassware can be supplied if required. The diffuser used is of the 12-in. size, and the total height of the apparatus is 5 ft. 4 in.

A New Blue-Printing Machine.

Very high speed of production, good-quality prints, and low-operating cost are outstanding claims for the new "Pease Peerless" model 30 blue-printing equipment as announced by the C. F. PEASE Co., 813, North Franklin Street, Chicago, Illinois, U.S.A. This new "Peerless" model 30 continuous blue-printing machine is direct gear driven throughout, has a speed range of from 4 in. to 12 ft. per min., and is driven by a variable-speed ¼-h.p. motor directly connected to a fully enclosed gear reduction unit running in oil. At the extreme left-hand side of the machine, mounted in the feed table, is a special four-point auto-type gear shift providing for two forward speeds, high and low, and also neutral and reverse. This reverse gear is, it is claimed, an entirely new departure in blue-printing machine construction, and on the model 30 it permits the operator to withdraw tracings or run back the leader roll whenever desired without inconvenience. The machine is made in two sizes, 42-in. and 54-in. widths, either for 110 or 220 volts d.c., or 220 volts a.c. The 42-in. machine is equipped with six lamps, and the 54-in. machine is equipped with seven lamps. These lamps are of the special type "P" enclosed-arc style, and are loaded at 6½ A on d.c. or 7½ A on a.c., when adjusted for their most effective printing speed.

A New Gas Detector.

After five years of patient research an all-British device has just been patented which will enable any person of average intelligence to detect and measure accurately the presence of any known combustible substance in the atmosphere. The new detector, which is a product of Messrs. J. H. NAYLOR, LTD., of Wigan, is contained in a small aluminium case weighing no more than 9 lb., and is a reliable device for the accurate measurement of noxious vapours, which are such a source of constant danger, not only in industry, but also in the daily life of public utility undertakings. The detector can give accurate readings up to one-twentieth of 1 per cent. of inflammable gas in the atmosphere, and its operation is very simple. Its greatest value is in encountering the great danger from fire-damp in coal mines. Hitherto hundreds of attempts have been made to produce a means of detecting these fumes, as the miners' safety lamp is the only reliable means available, but even with the lamp the firemen cannot detect very small amounts of fire damp, nor can they find out where there is an increase or decrease in the percentage. The device is claimed to be absolutely safe, as tests have repeatedly been carried out in explosive atmospheres. The detector has been fully tested by the Mines Department at its Sheffield testing station, and is certified safe and accurate, and approved for use underground. The detector makes use of the principle of the combustion equation of C.H.4 in air. It is unaffected by the temperature, and tests carried out in a room heated to 70 deg. F. and in temperatures below freezing point, were equally accurate.

New G.E.C. Developments.

For accurate results in cell-testing work it is essential to use a high-grade instrument which does not require excessive current and which has a low temperature error. The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, has recently put on the market a new type of cell-testing voltmeter, which has been specially designed to meet these conditions. This voltmeter, fig. 2, possesses a high internal resistance (approximately 100 ohms per volt), and is wound with resistance wire of negligible temperature error, so that it is suited to the requirements of accurate work. A 2½-in. scale is fitted, and the movement is of the spring-

Fig. 2.—"Magnet" Cell-testing Voltmeter.

controlled moving-coil dead-beat type. The instrument is supplied with an interchangeable handle and spear with flexible lead, complete in a leatherette case. For wireless work the G.E.C. has developed a special form of this instrument, having two ranges (0/12 and 0/120) volts). The ranges are controlled by a substantial two-way switch, a reliable and convenient method that leaves both hands free to manipulate the testing leads.

We are interested to learn that the GENERAL ELECTRIC CO. is now manufacturing "Magnet" electric irons with the domes finished in blue, green or red enamel, the sole and handle support being nickel plated. The company has lately built and equipped at its Landor Street, Birmingham, works, a new section for carrying out high-class enamelling work in large quantities, more especially to cope with the vitreous enamelling of parts of "Magnet" cookers and fires. It is claimed that the enamel is impervious to changes of temperature, and that it will not chip or peel.

Instrument Transformers.

A general review of the subject and an outline of the authors' views and development work for which they have been more particularly responsible.

By J. G. WELLINGS, A.M.I.E.E., and C. G. MAYO, M.A., B.Sc., Grad.I.E.E.

(*Extracts from a paper read before the* METER AND INSTRUMENT SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE subject deserves more specialised attention and general publicity than it has hitherto received. Whilst admittedly only ancilliary apparatus, instrument transformers are, nevertheless, of such importance in modern switchgear that, unless specially considered, they may constitute the weakest point in the gear.

From the meter standpoint, the first consideration is the high degree of accuracy now necessary; from the switchgear standpoint, primary importance is attached to rendering them suitable for the switchgear and for the short-circuit conditions which require to be met. The result is that one or other of these two somewhat conflicting requirements is generally to some extent overlooked; hence little advance has been made in producing a transformer which meets equally the requirements of both. Instrument transformers for protective gear should embody certain features which are no less important than either metering accuracy or ability to withstand short-circuit conditions. The authors have, therefore, made a special study of instrument-transformer design with a view to reconciling the needs of all three interests. Whereas in a voltage transformer the effect of secondary burden is to produce current through the windings without appreciably affecting the flux in the core, in a current transformer the effect of burden is to produce flux in the core without appreciably affecting the current in the windings. A further contrast is that zero burden on a current transformer corresponds to a short-circuited secondary, while on a voltage transformer this condition corresponds to an open-circuited secondary. In a current transformer, it is the production of flux in the core that has hitherto been the source of all error; thus, in order that the secondary current might be an accurate representation of the primary current, it has been necessary to keep to a minimum the losses incurred in producing the flux. The authors have, however, developed means by which the errors of a current transformer are no longer merely a function of these losses, but may be compensated for and the accuracy of the transformer maintained, even though the losses may be relatively high. This has naturally changed the whole outlook on current transformer design and application, and is having a far-reaching effect on switchgear in general.

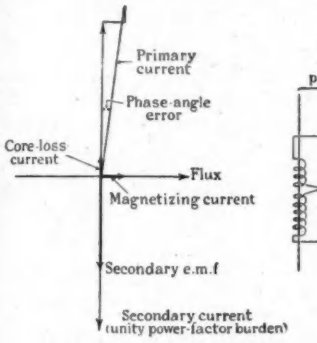
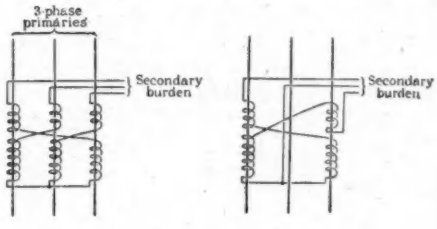


Fig. 1.—Vector Diagram of Current Transformer.



Figs. 2 and 3.—Compensated Transformers.

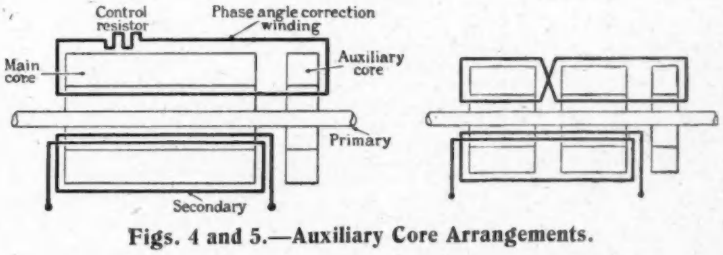
Current Transformers.—The conclusions reached are that the reduction of ampere-turns is the only real means of increasing the short-circuit capacity. High accuracy can, and should, be obtained without recourse to a large number of ampere-turns.

The authors accordingly concentrated on means of obtaining the highest degree of accuracy with a primary of the bar type and a core of ordinary silicon steel, full advantage of which can be taken as regards known characteristics and permanency in performance. The same means, however, can be employed with any type of high-permeability alloy cores, and a saving effected in the amount of such material required.

It has been almost universal practice for ratio error to be corrected to some extent by adjustment of the number of secondary turns. This involves the provision in the secondary winding of slightly fewer turns than the nominal number, so that, the ampere-turns being constant, the current is slightly increased and corrects for the discrepancy due to core loss. Hitherto, however, there has been no practical means of correction for phase-angle error, with the result that this error has always been the limiting feature in design, and has required to be kept to a minimum by the use of liberal core section and ampere-turns. Moreover, it is of greater importance to minimise phase-angle error than ratio error, since, while the latter is independent of the power factor of the main circuit in its effect on metering errors, phase-angle error changes in effect with the power factor of the main circuit, being greater the lower the power factor. The reduction of phase-angle error to the minimum is, therefore, of very great importance if the highest possible metering accuracy is to be obtained. Of course, it is possible to correct for some of the error of a current transformer by special adjustment of the meter when calibrating with the transformer. The authors concentrated, however, on reducing the inherent errors of the transformer and rendering them as far as possible negligible, so that in the ideal case the use of the transformer introduces no errors in itself and reduces the overall errors of the combination practically to that of the meter only.

It is convenient to regard the theory of ratio-error correction by conceiving the turn adjustment to be applied to the primary winding, in which case there would be a slightly greater number of primary turns than the nominal, the excess number simply providing the additional excitation necessary to allow for the discrepancy which occurs due to core loss. A further step is to regard the extra primary turns as being physically separated from the main primary turns, but carrying current which in phase relationship and in ampere-turns provides exactly the same effect as when the extra turns are actually part of the primary winding.

In fig. 1, which shows the elementary vector diagram of a current transformer, under unity power factor conditions of secondary burden it will be noted that the core-loss component is practically in phase with the primary current, and, therefore, can be corrected for by supplying additional excitation in phase with the primary current. If such additional excitation could be supplied with an angular displacement with respect to the primary current, then there would be a component available for correcting the core-loss and magnetising-current errors.



Figs. 4 and 5.—Auxiliary Core Arrangements.

If it were possible to excite the current transformer separately in such a way that the separate excitation was exactly equal to the total excitation, both in magnitude and in phase, then the current transformer would operate without error between the main primary and secondary. Broadly speaking, it is along these lines that the authors have developed their type of compensated current transformer.

In its simplest form auxiliary excitation may be obtained by the provision of a small auxiliary winding associated physically with the secondary winding, and energised from the secondary winding of a current transformer in one of the other

phases of a polyphase circuit. On a 3-phase circuit this automatically provides 60-degree phase displacement, which forms a convenient value for providing components to take care of the core-loss and magnetising-current errors. Fig. 2 shows transformers connected in this way; if two transformers only are used, the connections are as shown in fig. 3.

By this arrangement phase-angle correction is made possible in the same way as ratio-error correction, and the error for a given value of ampere-turns is reduced, or, what is more important, the same accuracy is obtained with a reduction in ampere-turns; this means that the bar-primer transformer is given an extended range of application on the lower ratios. The method developed to accomplish this was to embody a small auxiliary core within the structure of the transformer to energise the phase-angle correction winding. In order to obtain the necessary phase relationship the auxiliary core requires to be operated at a relatively high flux density, which, as well as accurate control of the auxiliary exciting current, is secured by inserting suitable resistance in the auxiliary exciting circuit.

This scheme is capable of producing phase-angle correction similar to the earlier developments, but with the advantage that the correction is obtained from the same phase, rendering feasible a self-contained transformer. The general arrangement is shown in fig. 4. At this stage further possibilities were seen by which, in addition to displacing the phase-angle curve nearer to, or even to cross, the zero line, the curve itself could be " flattened " by arranging the design of the auxiliary core so that there is a greater relative auxiliary excitation at light loads than at full load, with the result that where the error is greatest the correction also is greatest.

This constitutes a very important advantage, in that previously it had never been possible, however liberal the provision of ampere-turns or iron cross-section, to obtain a flat characteristic. Even the use of high-permeability alloys for the core material does not provide this feature, which has a very important effect on the accuracy of a meter at light loads.

The same auxiliary core can also be made to correct and compensate for ratio error and thus be used to obtain a flat characteristic for this feature, in addition to that of phase angle. To give this effect a few turns of the secondary winding are taken round the auxiliary core so that the flux of the auxiliary core leads that of the main core, in practice by nearly 90 degrees, and induces a leading e.m.f. in the secondary turns embracing the auxiliary core. The voltage in the secondary circuit is purely a function of the secondary burden, and not of the transformer. Therefore, for a fixed burden, if a leading voltage is introduced, in order that the total secondary voltage as determined by the secondary burden may remain unchanged, the main secondary voltage as produced by the main core must be caused to lag sufficiently to neutralise the effect of the leading voltage. This angle of lag in the main secondary voltage causes the main flux also to lag behind its normal position and, in turn, the magnetising current for the main core lags behind its normal position. Of course, an increase in the secondary current is equivalent to a positive ratio error, and the latter determined in this manner can be arranged to off-set the natural negative ratio error. Control of the ratio correction so obtained can be effected in the same way as in the case of phase-angle compensation, *i.e.*, greater relative correction may be obtained at light loads than at full loads, so that the resulting ratio-error characteristic is flat.

Thus both ratio and phase-angle errors are now capable of adjustment as required and, for any given amount of error resulting from a given condition of secondary burden, a transformer can be designed which will have both its ratio and phase-angle curves coincident with the zero line. While this meets the requirements of any specific case in a way which has never before been possible, it is possible that a transformer compensated in this way, if sold on a commercial basis and not operated exactly at its rated burden, may be either over-compensated if the burden is less than the rated figure, or under-compensated if the burden is more.

The permeability of ordinary silicon steel reaches its maximum at a flux density which is considerably greater than the density at which it is possible to operate the core of the current transformer. Accordingly, by maintaining a core at the optimum point of the permeability curve by means of auxiliary excitation, the change in flux density due to the secondary burden alternating about this optimum point can be obtained for an expenditure of magnetising ampere-turns several times less than usual. This scheme lends itself very readily to the compensated current transformer described above. The main core merely requires splitting into two portions, each being magnetised in the opposite sense by a winding energised from the auxiliary core which provides ratio and phase-angle compensation; fig. 5 shows the core and windings arranged for this duty. The two portions of the core being magnetised in the opposite sense, there is no resultant effect on the secondary winding if the two portions are equal, as the induced e.m.f.'s in any winding which embraces both portions will cancel out. Actually, however, it is sometimes convenient to arrange for the two portions to be slightly unequal, which has the same effect as keeping proportions equal and retaining the ratio compensation by some of the secondary turns embracing the auxiliary core.

By this " cross magnetisation " the ratio and phase-angle errors are reduced to roughly one-third of the figures normally obtained by the use of silicon-steel cores. Furthermore, the natural phase relationship which exists between the " cross flux " and the main flux is such that an improvement can be obtained when the secondary burden becomes reactive. This automatically compensates for the greater ratio error which otherwise exists when the burden becomes reactive. Accordingly, in a good many instances the use of cross magnetisation is sufficient in itself to give the required accuracy for commercial application, but, as in the case of the use of special alloy cores, the errors can never be reduced to zero, and when the highest degree of accuracy is necessary a combination of cross magnetisation and compensated windings is necessary. A further possibility of the compensated windings is that, if necessary, they actually permit of the ratio and phase-angle errors being reversed at light loads, *i.e.*, the ratio error, instead of dropping to negative values as it does with an ordinary transformer, can actually be made to rise, and the phase angle to fall. This characteristic may be of advantage in compensating for any inherent error in the meter which, unless otherwise corrected, droops on light loads; thus in such instances the introduction of the compensated current transformer improves the accuracy of the meter. Summarising, the chief points of advantage are:—(1) A degree of precision accuracy is obtainable which is not possible with any other type of transformer built hitherto, particularly with regard to the " flat," or " inverted," characteistic, and the possibility of adjusting for zero error at any specified burden. (2) This high degree of accuracy may be combined with the use of the bar-primary construction.

In view of the absolute security of the bar-primary transformer against breakdown due to heavy overloads or surges, in all important power-station work the use of the multi-turn primary transformer should in future be abolished. Typical accuracy characteristics of precision-type compensated current transformers are given in Tables 1 and 2. They are commercial transformers designed to satisfy the conditions of accuracy necessary in metering supplies from the " grid."

TABLES I AND II.—ACCURACY CHARACTERISTICS.

Ratio 400/5 amps.; frequency 50 cycles per sec.; rating 15 VA.

Primary current. Per cent. of rated value.		Ratio error. Per cent.		Phase angle. Min.
125	...	+0.12	...	17
20	...	+0.14	...	10
10	...	+0.12	...	11
5	...	+0.17	...	8

Ratio 800/5 amps.; frequency 50 cycles per sec.; rating 15 VA; adjusted to have increased positive ratio error at light loads.

Primary current. Per cent. of rated value.		Ratio error. Per cent.		Phase angle. Min.
125	...	+0.15	...	10
20	...	+0.30	...	9
10	...	+0.40	...	3
5	...	+0.65	...	0

Protective Transformers.—There has been a tendency to accept too readily the supposed unavoidable imperfection of protective current transformers, and much ingenuity has been expended in devising means of securing high values of stability ratio, usually by endeavouring to nullify the premised lack of perfection in the performance of the current transformers. The conclusion is that current transformers are not necessarily the limiting features in the performance of protective gear; but that they can, and should, be designed to be " ideal transformers " so far as the requirements of the protective systems are concerned.

Voltage Transformers.—They do not appear to be readily adaptable to the same advances in design as current transformers. Progress has accordingly been associated more with improvements in mechanical arrangement, and with special features concerned with the accommodation of the transformer in the switchgear. A somewhat extreme development has been the elimination of the voltage transformer altogether when particularly high-voltage ratings are concerned. A means of doing so is the utilisation of an existing power transformer,* connecting the voltage transformer to the low-voltage side, and compensating for the regulation of the power transformer.

It is concluded that voltage transformers are a satisfactory proposition on low-voltage circuits, subject to suitable pro vision of protective fuses and resistors.

* ELEC. REV., November 29th, 1929, p. 967.

Power from the Sea.

Mr. P. A. C. Bates, a Sydney engineer, who has for some years been investigating the possibilities of the production of power on a commercial scale from sea water, has installed a mechanical device at Lurline Bay, near Coogee, Australia, for practical demonstration. Waves running into and out of a specially made channel in the rocks operate floats on pontoons which, in their turn, operate pumps. The latter force water at high pressure into accumulators, which are equipped with safety valves and pressure gauges, and thence passes at regulated pressure to water turbines coupled direct to electricity generators.—*Reuter's* (Sydney).

The Electricity Commissioners' Work.

Extracts from their Ninth Annual Report, 1928-29.

THE ninth annual report of the Electricity Commissioners,* covering the period April 1st, 1928, to March 31st, 1929, in its prefatory observations, refers to the great progress made in the preparation and carrying out of regional schemes. Three further schemes have been adopted with certain modifications by the Central Electricity Board; these relate to Central England, North-West England and North Wales, and Mid-East England. The total value of contracts for the five schemes adopted amounted at March 31st to £8,150,000. These schemes cover the areas of 450 undertakers, 43 per cent. of the total area, 75 per cent. the population of Great Britain, and 80 per cent. of the sales of electricity.

Authorised Undertakers.

Inclusive of the Central Electricity Board and allowing for two companies with undertakings in England and also in Scotland, the number of separate undertakings was 659, a net addition of 17, consisting of 383 local authorities, 269 companies and persons, three Joint Electricity Authorities, and five Joint Boards.

Generation and Consumption.

The energy produced by the total of 564 stations making returns amounted to 10,878,980,925 kWh, with a fuel consumption of 9,526,868 tons of coal and coke, 183,385 tons of coke brieze, and 35,241 ton of oil. The 486 stations of authorised undertakers produced 9,473,201,134 kWh. This represents an increase in output of some 9.5 per cent., though the fuel used increased by only 3.7 per cent., the increase in output over the past eight years has averaged 13.8 per cent. per annum, while the amount of electricity produced per ton of coal and coke has increased by 60 per cent., as compared with 1920-21. The number of stations closed down was 27, but 21 others came nto operation, making a net reduction of six. The majority of the new stations were of small capacity, situated in isolated districts, but notable exceptions were the New Brimsdown station of the North Metropolitan Power Station Co., the Longford station of Coventry Corporation, and the Maentwrog hydro-electric station of the North Wales Power Co. Of the 564 stations referred to above, 250 (44.3 per cent.) generated less than 1,000,000 kWh each, while 386 stations (68.5 per cent.) generated less than 10,000,000 kWh each. The remaining 178 stations generated 94.7 per cent. of the total output.

The energy sold increased by nearly 11 per cent. to 7,603,290,446, of which local authorities were responsible for 4,775,642,213, and companies for 2,827,598,233. The increase during the past six years has exceeded 108 per cent. or 18 per cent. per annum. The sales of electricity from public sources represented 171 kWh per head of population.

Electricity Supply in Rural Areas.

Nine companies with large supply areas are concerned with proposals for development under recent private Acts. The included areas are mainly rural. The total extent of such areas under development is 12,246 square miles, with a population (1921) of 1,583,500, giving an average density of 129 persons per square mile. Of the 659 undertakers, 309 are authorised to supply in rural areas.

An area forming part of the supply area of the Corporation of Bedford has been selected by the Minister of Transport for carrying out a demonstration rural supply scheme. A technical officer specially concerned with the fostering of rural electrification has been oppointed.

New Generating Stations.

The aggregate sanctioned capacity of generating plant for new stations and extensions of existing stations amounted to 602,818 kW. The plant sanctioned for new stations was less than in the preceding year, but the plant sanctioned for extensions was greater by about 62,000 kW. Of the generating plant sanctioned during the past nine years, 59.8 per cent. was for public authorities, 33 per cent. for companies, and 7.2 per cent. for railway, tramway, and non-statutory undertakings.

The Commissioners issued 12 consents (six to authorised undertakers, five to non-statutory undertakings, and one to a railway company, for the establishment of new stations, with an aggregate initial capacity of 119,250 kW. Two of the principal consents authorised the erection of selected stations (*viz.*, Ironbridge station of West Midlands J.E.A., and Clarence Dock of Liverpool Corporation), with an initial capacity of one 50,000-kW set each.

Extensions of Existing Generating Stations.

Consents to the extension of existing stations were given to 60 authorised undertakers (66 consents), and in five further cases to railway and tramway authorities and non-statutory undertakings, representing in the aggregate a plant capacity of 483,568 kW. The division of this total was as follows:—local authorities, 340,547 kW; companies, 112,346; railway and tramway authorities, 30,500 kW; and non-statutory undertakings, 175 kW. Consents authorising the installation of units with a capacity of 10,000 kW or more in existing stations were issued to 19 authorised undertakers and 2 railway authorities; these consents accounted for 428,000 kW, or nearly 90 per cent. of the above aggregate. Plant sanctioned included one set of 50,000 kW in Portishead station (Bristol Corporation); 30,000 kW sets in the stations of Battersea B.C., Hackney B.C., and West Ham Corporation; and 25,000 kW sets in Deptford station (London Power Co.), and Treforest station of the South Wales Electrical Power Distribution Co. Three applications for consents, *viz.*, by Hornsey and Southend Corporations and Landillo U.D.C., were refused, since cases for extended local generation, as compared with the alternative of a bulk supply, have not been proved to the satisfaction of the Commissioners.

Main Transmission Lines.

Consents were issued to the Central Electricity Board for the erection of 132-kV overhead lines; *viz.*, 228 route miles for the Central Scotland Electricity Scheme, and 37¾ miles for the South-East England Scheme; and for the erection of 33-kV overhead lines, *viz.*, 6¾ miles, for the South-East England Electricity Scheme (Brighton to Worthing), and 12 miles for the North-West England and North Wales Electricity Scheme (Stockport to Macclesfield).

Consents were issued to other authorised undertakers in respect of 22 applications, which, in ten instances, related to 33-kV overhead lines. The consents included those relating to the interconnection of the Birkenhead and Wallasey stations; and of the Portishead and Ferder Road stations (Bristol Corporation); the undertakings at Hereford, Ross, and Leominster; and the transmission developments by the Bedfordshire, Cambridgeshire, and Huntingdonshire Electricity Companies, the Corporation of Coventry, and the Wessex Electricity Co.

Special Orders.

At the commencement of the year 80 applications for Special Orders relating to the establishment or extension of existing undertakings were under consideration, and during the year 72 further applications were received. The Commissioners made Special Orders in respect of 67 of the applications. Of the other applications, 6 were refused and 4 withdrawn, the remaining 78 being still under consideration at the end of the year.

Of the 72 applications received during the year, 33 related to the establishment of new distribution undertakings, and 33 to the extension of existing areas of supply. Many of the applications covered a large area of supply. 17 of the above applicaions competed with current or prior applications, but the element of competition was not quite so pronounced as in previous years. In the course of the year six inquiries affecting 24 applications were held.

Sanction of Loans.

Consents were issued in respect of seven applications by the Central Electricity Board to the borrowing of sums aggregating £13,900,000, including £5,400,000 for standardisation of frequency, and £8,500,000 for main transmission lines, transforming stations, and preliminary expenses.

At the beginning of the period, 162 applications from local authorities, joint boards, and joint electricity authorities were under consideration, and 734 further applications were received during the year. Sanctions, in full or in part, were issued in 600 cases. Allowing for 30 applications refused, withdrawn, postponed, or transferred to other Departments, 266 applications remained under consideration at March 31st, 1929.

Loans sanctioned (less cancellations and excluding the Central Electricity Board) amounted to £15,261,298—about £2,700,000 less than in the previous year.

Sanctions amounting to over £1,000,000 were issued to Sheffield Corporation, nearly 75 per cent. of which related to mains and services, while in four cases sanctions amounting to £500,000 or over were issued to the West Midlands J.E.A.: for the Ironbridge station, to Bristol Corporation for, *inter alia*, the Portishead station, to Leeds Corporation for the Kirkstall station, and to West Ham Corporation for, *inter alia*, extensions to its station.

The amount of the loans sanctioned for wiring installations and for the purchase of domestic apparatus for hire or hire-purchase amounted to £501,689.

Of the £131,681,532 sanctioned in nine years, 41 per cent. was for generating plant, 39 per cent. for mains and services,

* H.M. Stationery Office, price 3s. net.

and the remainder for land, buildings, and other permanent works, meters, wiring, domestic apparatus, and the acquisition of established undertakings.

Superseded Works.

In dealing with applications relating to the replacement of existing works, the Commissioners require to satisfy themselves that special provision is made for the liquidation of any debt which may be outstanding. A distinction should be made between (i) works which have become worn out or ineffective and require to be replaced by new works; and (ii) works which would still have remained serviceable if their replacement had not been rendered necessary in the interests of general development and economy of operation, *e.g.*, mains replaced as a consequence of a change-over from d.c. to a.c. distribution. Any outstanding debt on works falling within the first category should at once be liquidated unless an undue financial burden would be imposed by such a course, in which event they would regard it as reasonable for the liquidation to be spread over a short term of years. In the case of works falling within the second category, the Commissioners do not consider it incumbent that provision should be made for the immediate discharge of any outstanding debt, but at the same time they would expect accelerated provision for repayment as far as financial circumstances permitted. In cases where no replacement of a disused asset is necessary, for example where generating plant ceases to be used on account of the taking of a supply of electricity in bulk, the question of acceleration of debt repayment is a matter for the discretion of the undertaker concerned.

Bulk Supplies.

Further progress was made in regard to bulk supply developments, as indicated in Table I.

TABLE I.—BULK SUPPLIES TAKEN AND ARRANGED.

Source of Bulk Supply	Number including cases of reciprocal supplies. By Local Authorities.	By Companies.	Totals.
From Joint Electricity Authorities	3	1	4
From Local Authority Undertakers	92	64	156
From Company Undertakers ...	126	101	227
From Non-statutory and miscellaneous sources	29	21	50
	250	187	437

There was an increase of 42 in the number of bulk supplies taken or arranged for. The above approximate figures are inclusive of bulk supplies derived from more than one source by individual undertakers. In the case of the supplies (387) taken, or arranged, from authorised undertakers, the bulk suppliers numbered one Joint Electricity Authority, 96 separate local authority undertakers, and 47 separate company undertakers.

The Commissioners gave their approval in 28 cases to certain authorised undertakers entering into and carrying into effect arrangements for mutual assistance or for bulk supplies. Of these approvals, 24 were given under the General Acts, one under the provisions of an Electricity District Order, and three under the provisions of Special Acts.

(To be continued.)

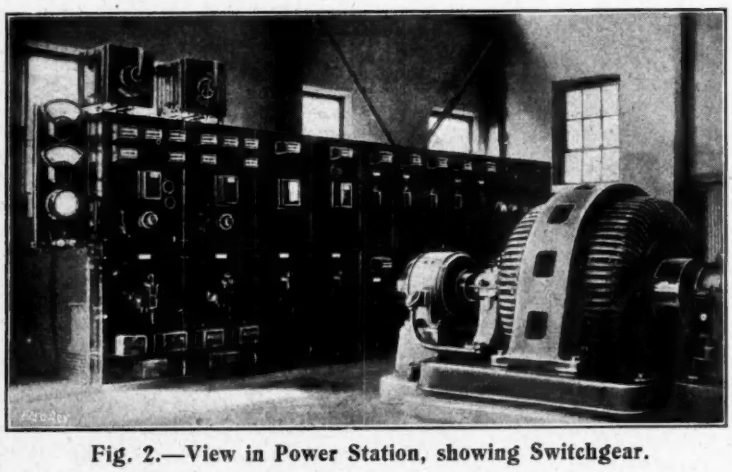


Fig. 2.—View in Power Station, showing Switchgear.

The Electrification of Nitrate Oficinas.

Some descriptive notes on the San Andres Nitrate Oficinas Power Station.

BY the application of electric power for driving the machinery in oficinas for the production of nitrate of soda from the crude saline deposits in the northern deserts of Chile, running costs are being reduced, and oficinas which have been closed down as unprofitable under the methods of working adopted by the early operators can now be operated satisfactorily. The power plant and electrical equipment of many oficinas are on the most modern lines, and well-equipped power stations are supplying power to pumping stations which may be as much as 15 miles away.

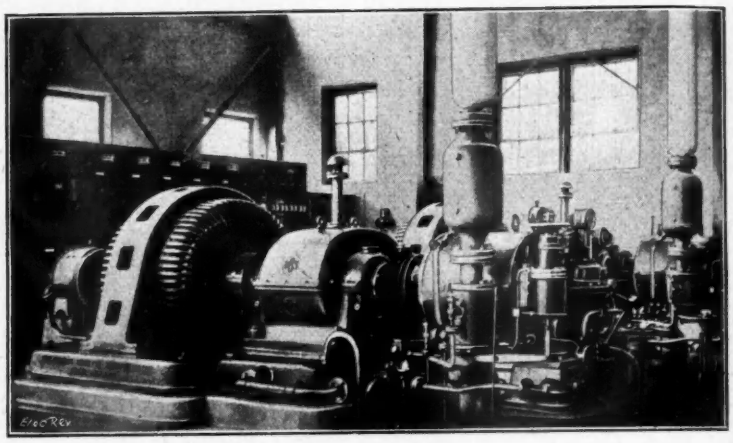


Fig. 1.—Geared Turbo-alternators in the Power Station of the San Andres Nitrate Oficina.

A typical power station, figs. 1 and 2, is that connected with the San Andres Nitrate Oficinas belonging to the Tarapaca and Tocopilla Nitrate Co., Ltd., the electrical equipment having been manufactured by the British Thomson-Houston Co., Ltd., and supplied through the British & Foreign Machinery Co., Ltd. Fig. 1 shows the geared turbo-alternators in the power station, while fig. 2 gives a view of the switchgear.

The equipment for the electrification includes two 400-kW, 440-volt, geared turbo-alternators, a 300-kW, 5,500-volt water-wheel driven alternator, 300-kW rotary convertors, switchgear, motor-generators, and over 60 induction motors, ranging in size up to 100 h.p., while for haulage purposes there have been supplied two trolley locomotives of 18 tons capacity, and two trolley and battery locomotives of 19 tons capacity.

The turbines are 6-stage geared back-pressure machines having a normal rating of 400 kW, 8,000 r.p.m., with steam conditions 300 lb. per sq. in. gauge, 350 deg. F. superheat and 40 lb. per sq. in back pressure. These turbines are coupled through single reduction double helical gearing to three-phase alternators running at 1,000 r.p.m. and rated at 500 kVA, 440 volts, 50 cycles, 80 per cent. power factor, with normal overload capacity of 25 per cent. The water-wheel alternator is rated at 375 kVA, 5,500 volts, three-phase, 50 cycles, and is driven at 500 r.p.m. through flexible couplings by a Boving turbine. The overload capacity is 25 per cent. for two hours and the temperature rise is guaranteed not to exceed 40 deg. C.; when tested before dispatch the temperature rise was 25 deg. C. and the efficiency at full load 92.5 per cent.

All the power station auxiliaries, such as pumps, conveyors, &c., as well as the pumps, crushers, winches and other plant used in the various manufacturing processes are driven by B.T.-H. squirrel-cage or slip-ring motors.

A rotary convertor traction sub-station for the haulage locomotives previously mentioned is fed by overhead line from the power station at 5,250 volts. The motor-generators are for charging the locomotive batteries.

American Diesel-electric Tankers.

The Lake Tankers Corporation, St. Louis, U.S.A., has ordered from the Bethlehem Shipbuilding Corporation two Diesel-electric tankers, 192 ft. long with a beam of 32 ft., capable of carrying about 1,000 tons of oil in barrels.

Recent Progress in Electro-deposition.

Extracts from a Presidential Address: a Plea for Definite Co-operative Industrial Research.

(*Report of a meeting of the* ELECTROPLATERS' & DEPOSITORS' TECHNICAL SOCIETY.)

THE proceedings at the annual general meeting of the above-named Society were replete with interest, a good muster of members being present. The new president, Dr. R. S. Hutton, director of the British Non-Ferrous Metals Reseach Association, was inducted into the chair by Mr. S. Field, A.R.C.S., who retired from the presidency after three years of successful active service and unremitting work in the interests of the Society.

The President's Address.

The presidential address was listened to with great interest, Dr. Hutton's text of "The Recent Awakening of the Electro-Depositing Industry" being calculated to inspire the response of his hearers The term "electroplating," at first confined to silver plating, now covered practically all surface coating by electrolytic means. Considering the very crude plant available in the early days, deep respect was due to the splendid work of the early pioneers. Unfortunately, the pioneer period having passed, the fraternity of electroplaters seemed to have "dug themselves in" and relied more on their inheritance from the past than on their own contributions to the advancement of the science and art of electro-deposition. Under such circumstances it was astonishing what small-minded ideas developed of the value of secrecy, all such ideas being directly antagonistic to progress.

Within the last few years the whole outlook had shown a marked improvement. Wider objectives had opened out, a number of metals had been added to the palette of the plater, and he was now able and willing, not merely to decorate the knick-knacks of the wealthy, but also to afford a high measure of protection to structures and even to offer the engineer improved strength and hardness, thus opening up many new applications.

Research and the Industry.

It seemed that the industry was benefiting perhaps even more from the advance of knowledge in subjects which at first sight appeared only to indirectly concern it, than from the science of electro-deposition itself. All the newer applications depended so much on the properties of the metal coating; for instance, recent research had given them quite new conceptions of the whole mechanism of corrosion and tarnishing, but extensive though that work had been, it but pointed the way for much further knowledge, for undoubtedly systematic research should lead to a much better choice of metallic coatings for withstanding discoloration, or more serious attack under severe conditions of service. Then, again, the surface hardness, whether it be required for producing scratchless surfaces, or so soft as would readily flow, and thus assist in making the coverings more perfect, although now to a large extent under the control of the electroplater, still depended much upon research of a more physical nature.

The colour of metal coatings was another matter of extreme importance, and, although by empirical methods something could be done to control it, proper investigation of the reflection of metal coatings of light of different wave-lengths and the influence of the conditions of electro-deposition in controlling colour, were matters in which all ought to take interest. Considering the very close link between their subject and that of polishing metals, it always appeared to be curious that the polishing and finishing of metals did not receive more study and attention. In many metal industries the percentage of the total cost due to polishing was very high; yet seldom, if ever, did one hear of systematic attempts to attack the basic principles and to find ways of reducing the cost. The Industrial Fatigue Research Board's report on that subject had received far too little attention, and he was convinced that large savings in cost could be readily effected by anyone who took the trouble to organise production along proper lines.

In many cases more attention should be paid to the proper planning of electro-deposition research than was the case at present. For instance, in investigating a new method of deposition it was sometimes annoying to find a mass of data on the influence of the electrolyte, temperature, current density, and what not, on the efficiency of the metal deposition, but no record or trial of the adhesion of the metal, its freedom from pinholes, or other defects, or of how permanent it was after prolonged exposure. If only the optimistic workers who, one after another, claimed to have discovered the ideal process for electroplating aluminium had carried out their work on some such basis, what a vast amount of disappointment would have been avoided.

It was probably the case of oxidation rather than its unattackability, which made chromium so valuable as a surface coating and as an alloy constituent, and what they needed to achieve still further advance was to study the properties and the optimum conditions of the formation of those thin and invisible oxide films. Until quite recently the search was for "super-metals," which generally meant "noble," with their characteristic high prices. To-day they knew that non-corrosive and non-tarnishing properties depended on "passivity," or the power of forming invisible protective films, and search might thus be made amongst relatively cheap and common metals to find the best condition to assure the particular service in view.

Another direction in which he believed electro-deposits would find a wide use, despite early disappointments, was in the "cementation" of steel and other underlying metals for their applications in high-temperature services. Abroad quite a number of investigations had been reported in which chromium, zirconium, and other metals had been made to penetrate by diffusion the surface layers of steel, and thus afford protection and other good properties. The application of chromium for the protection of the moulds used in the pressed-glass industry was said to be of great economic importance, and, although that might not depend on real cementation, the example indicated the sort of service he had in view. He also emphasised his belief in the great possibilities which tin coatings appeared likely to offer.

Co-operation in Research.

The Electroplaters' and Depositors' Technical Society had played a most important part in encouraging discussions and intercourse between those engaged in different sections of the industry. However, much more was required: progress depended most certainly upon more active co-operation in pushing forward the limits of knowledge, and the more intimately they could themselves participate in those advances, the easier would it be to harness them to their daily industrial problems.

Within the last three or four years large sums had been devoted from outside the industry to subsidize research on electro-deposition, all of which had undoubtedly yielded important results, but that work would be more readily brought home to industrial appreciation and use if, in steadily increasing measure, the industry itself could provide some part of the funds required. In fact, the continuation of research might at any moment depend upon support being provided by the electro-deposition industry itself.

In the U.S.A. a similar state of affairs had existed, but recently a research fund had been mobilised and a large number of small individual firms had been found ready to contribute and thus assure the extension of the work. A really enthusiastic effort along those lines might surely produce quite a substantial total fund and, apart from bringing the needs of the industry more clearly into the research programme, encourage the continued expenditure of the Department of Scientific and Industrial Research on a scale which at present was apparently far beyond the means of the electro-deposition industry itself.

Electricity on Board Ship.

Electrical appliances on board the *Empress of Japan*, the latest addition to the Canadian Pacific Fleet, launched at the Clyde yards of the Fairfield Shipbuilding & Engineering Co., will include wireless telegraphy, direction-finding, and submarine signalling apparatus; electric sounding machines, gyro-compass equipment, and "clear-view" screens; an orchestra and gramophone repeater installation, kinema apparatus, and an extensive telephone system. The electric lighting, heating, cooking, and power installations will be developed to a degree hitherto unattained on any first-class liner. The steering gear is to be of the electro-hydraulic type by Messrs. Brown Bros. and Co., Ltd., Edinburgh. In addition to the natural ventilating system, an elaborate system of mechanically supplying cold and heated air, together with a mechanical exhaust system by the Thermotank Co. using its improved punkah and revolving punkah louvres, will be installed throughout the vessel to suit the varying climes she will trade in. Auxiliary machinery is to be electrically driven and power is to be generated by four six-cylinder Diesel generators and two steam-driven turbo-generators.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

The Design of Electric Cooking Apparatus.

As one of the earliest workers in the design and manufacture of electric cooking apparatus, and now the representative of one of the largest firms of electric range manufacturers in the British Empire, I would like to congratulate "A Consumers' Engineer" on the practical and broad-minded views expressed in his article in your issue of December 27th. In Canada, the "home of electric cooking," where ranges are not hired out, but sold to the consumer, designers have been influenced in their work by the experience of housewives and cooks, rather than by an attempt to satisfy the conditions laid down by engineers and advisory committees, who have not always attached to the views of the users the importance they deserve. In Canada, quality and standardisation have advanced a stage nearer to the ideal than has been the case in this country. This being so, some comments on the article may, perhaps, be of interest to the author and to your readers, and I have selected some points for comment and criticism.

(1) It is obviously true that good cooking is of the first importance, though due weight must be given to thermal characteristics and efficiency.

(2) A beautiful and durable finish is essential and can only be given by the use of high-class vitreous enamels, inside and outside the range, but if some saving in cost is required, the back and sides may be finished with two coats of good stove enamel. On the hob plate hard vitreous enamel is easier to clean and more durable than nickel plating or other finishes.

(3) A high oven, following gas stove practice, is not the best for the average household. It is necessary with gas as in that case top and side burners cannot be used satisfactorily. A high oven means that the lower shelves are too near the ground, or that warming space is restricted, and is only of advantage when used for baking quantities of loaves of the English patterns. A wide oven with elements at the top and bottom gives the best heat distribution, but the top element should be used only for grilling and the first heating of the oven, and the bottom element with a suitable deflector plate should be used alone for baking and roasting. Such an arrangement gives an excellent self-regulation of temperature, rendering hand regulation or thermostat control unnecessary.

(4) Pull-out interiors are unnecessary, except where side elements are used, and are a nuisance.

(5) Welded oven linings are essential and, when used with a well fitted door and an always open ventilator of correct dimensions, properly placed, ensure the self-regulation of temperature is always obtainable.

(6) A good thermometer, easily read, should be on every oven. All the best cooks nowadays warm their oven to the temperature best suited to the food they are cooking. There is no difficulty in fitting a thermometer so as to represent truly the oven temperature. This has been proved by trials with pyrometers in the oven.

(7) Round hot plates are best, mainly because most cooking utensils are round, and we do not want to make the housewife purchase new and sometimes expensive utensils. If we can give results with those she has and is used to, all the better. With 200 volts and upwards exposed heating wires are inadvisable, even when protected by metal grids. Solid plates are being improved, and with the use of suitable materials, can be made sufficiently quick in boiling, and at the same time controllable. It is not wise to rely upon machined surfaces on hot plate or pot; intimate contact is useful if you can be sure of getting it, but in practice it is rarely obtained. An enclosed plate is now available where a large part of the heat is transferred to the pot by radiation, and the results obtained with ordinary utensils and even those with concave bottoms are remarkable.

(8) Grilling is best done by the top element in the oven, which can easily be of large area and is in a properly sheltered position, but in small cookers a separate grill with an element which grills and boils a kettle simultaneously is economical. This element should, and can, be totally enclosed top and bottom.

In the above notes I have not described or suggested any features that have not already been produced and tried out. I shall at any time be glad to show examples to "A Consumers' Engineer" and others who, like him, are interested in these matters.

Alan Williams, M.I.E.E.

London, S.W.1, *January 2nd*, 1929.

It is refreshing to read such a carefully considered and well-written article on electric cookers as that appearing in your issue of December 27th, under the heading "Electricity for the Home," by a Consumers' Engineer.

The author is evidently a man of experience and one who has given deep consideration to his subject. Though one may be excused from differing from some of the very interesting ideas and opinions which he puts forward, there is, as your editorial rightly points out, a welcome and much-needed warning, both to manufacturers and to the newer buyer, to resist the temptation to put on the market, and to buy, "shoddy" apparatus for the sake of cheapness.

The manufacturer who attempts to put all he knows into the design and construction of the modern electric cooker, is too often discouraged by the cry of the buyer "Too dear!"

A well-designed and well-constructed cooker may at first sight appear to be, comparatively, a little expensive, but it is never "dear." A cheap or shoddy cooker is always dear, whatever the price. This is a point that is becoming more and more apparent to experienced buyers, but is one which the inexperienced buyer totally fails to grasp.

Referring to the author's notes on boiling plates, it is strange to find that the belief still exists that an open or semi-enclosed type of boiling plate is faster in operation than the totally-enclosed plate. The contrary can be proved very readily, providing the test is genuine. That is, the two plates must be of the same surface area and loading. An exactly equal quantity (not a guessed quantity) of water at the same initial "cold" temperature must be used. Further, the test should be made with a flat bottomed utensil, otherwise the most amazing results can be obtained if the utensil is of the very cheap variety, with either a convex or a concave bottom.

It may be argued that such a utensil is not always found in the average household. Well, the reply is, that it should be. Why sacrifice the reliability of the boiling plate for the sake of the few extra shillings required to obtain satisfactory utensils?

It is difficult to understand the author's contention that the present popularity of the enclosed plate is only a temporary phase, and that the plate which comes to stay will be an open one. In the past decade, progress in boiling-plate design has been confined almost entirely to the solid or enclosed type plate. The open type has remained much where it was, inefficient, slow, and unreliable. The enclosed plate has improved enormously in both speed and reliability, and will improve still more in these respects. The question of flexibility is not insuperable, and will eventually come to oust the remaining advantage of the open plate.

J. J. McKenna.

London, S.W.1, *January 4th*, 1930.

With reference to the article by "Consumers' Engineer" in your issue of December 27th, the author does not appear to have had any experience of the "Superspeed" boiling plate manufactured by the Revo Company. This hot plate has all the advantages of both the enclosed and open types, as it is practicably indestructible and yet is much quicker and more efficient than either. Its only disadvantages are that it is higher in first cost and cannot be used on d.c. circuits.

J. Howard.

Taunton, *December 30th*, 1929.

Risum Teneatis?

I have been looking at the *Farmer and Stockbreeder* for the past few weeks, and in disgust send you the current issue. Not one electrical advertisement to show apparatus for use with power from mains! The Electrolux people show a refrigerator for use with an oil burner. Also note that a drum-type root cutter ("pulper"), complete with 2 h.p. oil engine, costs £32 10s. on a portable truck. No doubt the advertisement managers can trot out facts and figures to prove their policy is correct (a standardised printing block would suit the *Farmer and Stockbreeder* page). Two years ago a council in Kent gave authority to a gas scheme—to-day gas is burnt in the cottage near which an electrical pole line sails majestically to a dim and distant point. That is not all. A Kent advertisement calls for a canvasser for electrical development work, *single men only*. Would a married man be too energetic when providing for his family?

At Christmas I received from my cousin in the Midlands, a letter; it contained this: "We have gas *stoves* and lights in the village—we are coming on—not electric light—but still gas is better than oil lamps. We do find it useful in the mornings." Now this village is five miles from an electrical plant which includes the use of waste heat from a blast furnace, and has a large factory—50 families employed in a cottage industry as well as on heavy farm land. Do you wonder I heard a farmer say at a meeting: "The life of a man is very short in comparison with the age of the world, and it is difficult to grasp things so far ahead. There is no doubt that electricity is the power of the future. How soon it can be adapted to farming is difficult to say." Local electrical managers seem to want specialists in some particular detail when they make appointments, and then ask them to take up development work as a hobby.

W. J. Minton, A.M.I.E.E.

Ilford, *January 2nd*, 1930.

The Thawing of Waterpipes.

I was very interested in the note in your issue of December 20th on the subject of thawing water pipes by electricity, as I had occasion to utilise the heating properties of electricity in this way during the cold spell of this year—1929.

The method mentioned in your note, namely, the use of a specially wound transformer, would be quite satisfactory for the thawing of pipes inside the house, but in my own case the service pipe underground was frozen, and I cannot see how the method mentioned could have been satisfactorily used in this instance.

My method of thawing the pipe underground was to disconnect the neutral side of the electric cooker at the main switch and to make this connection on to the water pipe. The cooker was switched on full, and in less than two minutes there was a welcome flow of water from the tap.

I would suggest that if any of your readers find themselves in a similar predicament that they try my method, as it is simple and cheap, as it does not call for any special apparatus. If a cooker is not available, a 2-kW fire or any other form of resistance would possibly be sufficient for the purpose.

J.W.B.

Bromsgrove, *December 30th*, 1929.

[This method is, no doubt, efficient for the purpose. Its legality, however, is questionable, and we should not recommend its general adoption.—EDS. ELEC. REV.]

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

16,428. "System of sound recording and reproduction." J. Neale. June 6th, 1928. (Cognate applications, 17,663/28, 18,567/28, and 27,434/28.) (322,796.)

16,800. "Television apparatus and the like." J. L. Baird and Television, Ltd. June 9th, 1928. (322,776.)

17,079. "Methods of distributing sound waves from telephones, gramophones, and the like." A. Marr. June 13th, 1928. (322,777.)

19,715. "Distance relays for electric lines." Akt. Ges. Brown, Boveri et Cie. July 7th, 1927. (293,470.)

22,224. "Method of photographically recording acoustic frequency oscillations." Gramophone Co., Ltd., C. O. Browne, and W. F. Tedham. July 31st, 1928. (322,729.)

22,882. "Electric power stations." International General Electric Co., Inc. August 8th, 1927. (295,287.)

23,286. "Heated filament for thermionic valves." Dr. S. Loewe. August 15th, 1927. (295,637.)

23,594. "Radio direction indicators." H. Antranikian. August 16th, 1928. (322,805.)

25,580. "Producing electrolytic deposits of chromium which adhere well and penetrate well into any recesses." W. G. Poetzsch. September 10th, 1927. (296,988.)

25,723. "Supply of filament-heating current to the thermionic valves of radio receivers or the like." Fansteel Products Co., Inc. October 6th, 1927. (298,224.)

25,951. "Radio apparatus." British Thomson-Houston Co., Ltd., and T. H. Kinman. September 10th, 1928. (322,740.)

25,983. "Light signals." Westinghouse Brake & Saxby Signal Co., Ltd. March 10th, 1928. (307,482.)

26,004. "Condenser telephones." H. Vogt. September 10th, 1928. (322,744.)

26,344. "Automatic or semi-automatic telephone systems." Standard Telephones and Cables, Ltd., and E. P. G. Wright. September 13th, 1928. (322,794.)

26,345. "Automatic or semi-automatic exchange systems." Standard Telephones and Cables, Ltd., and E. P. G. Wright. September 13th, 1928. (322,795.)

26,401. "Electric communication cable." Standard Telephones and Cables, Ltd., and P. E. Erikson. September 14th, 1928. (322,811.)

26,453. "Electrical pick-ups and like reproducing or recording devices." C. Berrage-Moulton. September 14th, 1928. (322,813.)

26,473. "Portable talking motion-picture projection." Electrical Research Products, Inc. August 8th, 1928. (316,994.)

26,527. "Ignition apparatus for internal-combustion engines." J. G. North and W. J. North (legal representatives of R. B. North (deceased)) and A. Massey-Allen. September 15th, 1928. (322,816.)

26,875. "Apparatus for calling attendants." F. G. Bell. September 19th, 1928. (322,508.)

26,883. "Aerials and aerial systems." E. Green. September 19th, 1928. (322,714.)

26,918. "Tumbler switches." Siemens-Schuckertwerke Akt. Ges. September 29th, 1927. (297,831.)

27,135. "Thermionic amplifiers." H. Green and Celebritone, Ltd. September 21st, 1928. (322,814.)

27,275. "Electrical reproduction of sound." H. Green and Celebritone, Ltd. September 22nd, 1928. (322,826.)

27,285. "Vacuum electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. September 22nd, 1928. (322,827.)

27,336. "Electrical condenser." English Electric Co., Ltd., and W. E. M. Ayres. September 24th, 1928. (322,828.)

27,337. "Dynamo-electric machines." English Electric Co., Ltd., and E. H. H. Hassler. September 24th, 1928. (322,829.)

27,361. "Wireless receiving sets." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). September 24th, 1928. (322,830.)

29,996. "Telephone systems." Siemens Bros. & Co., Ltd., and W. G. Patterson. October 17th, 1928. (322,845.)

30,158. "Electrical power systems." Associated Electrical Industries, Ltd. October 20th, 1927. (299,054.)

30,894. "Illuminated direction-signalling device for motor road vehicles." E. Walster. October 25th, 1928. (322,850.)

30,955. "Electric switches for electric heating apparatus." General Electric Co., Ltd., and C. G. Eden. October 25th, 1928. (322,851.)

31,339. "Electric motor control." British Thomson-Houston Co., Ltd., W. J. Pool. October 29th, 1928. (322,856.)

33,727. "Vehicle bodies." Electricars, Ltd., and J. F. Monnot. November 17th, 1928. (322,871.)

33,936. "Radio apparatus." J. L. Gottlieb & Co., Ltd., and E. V. Kayley. November 19th, 1928. (322,872.)

35,137. "Electrical conduits and means of manufacture of same." Albion Clay Co., Ltd., and R. Lawton. November 29th, 1928. 322,882.)

35,908. "Electric drives for gramophones." D. S. Burleigh. November 30th, 1928. (322,884.)

35,988. "Arrangement in cross-bar switches." G. A. Betulander. December 6th, 1928. (322,888.)

36,430. "Means for supporting overhead electric lines or conductors." Pirelli-General Cable Works, Ltd., and J. R. Harding. December 10th, 1928. (322,891.)

36,470. "Electric dimmer switches." W. Row. December 10th, 1928. (322,892.)

36,829. "Electric incandescent lampholders." C. G. M. Bennett and C. A. Ely. December 13th, 1928. (322,897.)

36,862. "Electrical condensers." Sprague Specialities Co. December 13th, 1927. (302,294.)

37,150. "Circuit arrangements for the generation of simple harmonic oscillations." Telefonaktiebolaget L. M. Ericsson. December 17th, 1927. (302,589.)

37,309. "Safety device for electric lamp bulbs." P. G. Arguelles. December 17th, 1928. (322,904.)

37,582. "Portable wireless receiving sets." E. J. Lever (Trix), Ltd., and D. A. Lyons. December 19th, 1928. (322,907.)

1929.

271. "Oil-filled electric transformers." A. W. G. Tucker and Ferranti, Ltd. January 3rd, 1929. (322,920.)

1,334. "Sparking testers for internal-combustion engines." R. W. Jeffreys and F. Cannon. January 14th, 1929. (322,929.)

3,177. "Electromagnetic separation of complex ores." British Thomson-Houston Co., Ltd. January 30th, 1928. (305,102.)

3,523. "Electric switchgear." Switchgear and Cowans, Ltd., and G. H. Neep. February 2nd, 1929. (322,944.)

3,706. "Transformers." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). February 4th, 1929. (322,946.)

4,805. "Train-dispatching systems." General Railway Signal Co. February 28th, 1928. (306,944.)

4,864. "Aerial systems for wireless signalling." Telefunken Ges. für Drahtlose Telegraphie. February 24th, 1928. (306,538.)

6,790. "Locks or guards for electric lampholders." A. V. Bowater. March 2nd, 1929. (322,965.)

6,917. "Alternating electric current interruptors." G. Ellison and J. Anderson. March 4th, 1929. (322,966.)

7,164. "Electric discharge tubes." C. J. R. H. Von Wedel. March 7th, 1928. (307,424.)

9,005. "Electric furnaces." L. W. Wild and Wild-Barfield Electric Furnaces, Ltd. March 20th, 1929. (322,975.)

10,350. "Deoxidising apparatus for use with oil-immersed electrical apparatus." Associated Electrical Industries, Ltd. April 5th, 1928. (309,138.)

11,229. "Electrically-wound clocks." British Thomson-Houston Co., Ltd. April 12th, 1928. (309,550.)

14,712. "Television apparatus and the like." J. L. Baird and Television, Ltd. July 11th, 1928. (Divided application on 321,441.) (322,822.)

14,713. "Television apparatus and the like." J. L. Baird and Television, Ltd. July 11th, 1928. (Divided application on 321,441.) (322,823.)

20,120. "Electromagnetic pick-ups for disk gramophone or like records." J. Dieux. May 16th, 1928. (Divided application on 311,366.) (314,759.)

34,541. "Apparatus for regulating voltage in alternating-current distribution systems." J. E. Pollak (Ganz-Fele Villamossagi Reszvenytarsasag). June 1st, 1928. (Divided application on 322,199.) (322,775.)

36,171. "Electric junction boxes." S. O. Bowker. September 12th, 1928. (Divided application on 26,139/28.) (Cognate application 7,409/29.) (322,825.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned :—

DECEMBER 27th, 1929.

Aconiclock. No. 505,351. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—Aeronic Radio, Ltd., 90, Regent Street, W.1.

Stenode. No. 507 303; Radiostenode No. 507,626; Radiostenostat. No. 570,627; Stenodyne. No. 507,628, Stenolith. No. 507,629; and Stenostat. No. 507,630. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—James Robinson, 76, Millway, Mill Hill, N.W.7.

JANUARY 1st, 1930.

Sylustre. No. 508,.05. Class 5. Wire.—E. & A. Smith & Co., Ltd. Pyenot Works, Bradford Road, Cleckheaton, Yorks.

Vertex (lettering and design). No 506,273. Class 6. Electric vacuum cleaning machines.—A. Blackwood, trading as Saxonworks, Aldwych House, Aldwych, W.C.2.

Densor. No. 508,236. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—Arthur Preen & Co., Ltd., 22, Cricklewood Lane, N.W.2.

Pearlexo. No. 506,590. Class 50. Goods made wholly or chiefly of celluloid, including battery cases and parts thereof.—British Xylonite Co., Ltd., Hale End, E.4.

B.S.S. for A.C. Oil-immersed Switches and Circuit-breakers.

The British Engineering Standards Association has just issued a revision of British Standard Specification No. 116, which deals with oil-immersed isolating switches, oil-immersed switches, and oil-immersed circuit-breakers, the distinction between these classes of apparatus being defined by a statement to the effect that an *isolating switch* is intended only for interrupting circuit when there is no load-current, a *switch* being suitable for breaking a load current, and a *circuit breaker* being suitable for interrupting abnormal conditions, such as that of short-circuit. In the preparation of this revision due regard has been given to similar work done in other countries, with a view to co-operation in international standardisation. The specification is intended to cover indoor circuit-breakers up to 33,000 volts, and outdoor types up to 20,000 volts. Useful appendices are included, giving notes on the care and maintenance of circuit-breakers, and also on the measurement of voltage and sphere-gaps.

Copies of the Specification (No. 116-1929) may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, S.W.1, price 2s. 2d. post free.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BARNES (SURREY).—Cinema theatre, Sheen, with electrical work, for Alderman J. T. Mears.

BARNSLEY.—New block at sanatorium; city engineer. Extensions to factory, Peel Street; T. Taylor & Sons, Ltd. School (640 places), for the Borough E.C.; A. D. Mason, clerk. Additions to Empire Mill, Stocks Lane; Wm. Sugden & Son.

BATH.—Works extensions, for Sir Isaac Pitman & Sons, Ltd. (£20,000 to £30,000); Hayward & Wooster, builders.

BEXLEY HEATH.—Church and hall; G. E. Burgess, architect, Station Approach, Dartford (returnable deposit of £2 2s.).

BILLINGHAM.—Bank for Lloyd's Bank, Ltd.

BLACKHEATH (BIRMINGHAM).—Works extensions, Yew Tree Lane, for T. W. Lench, Ltd.

BOLLINGTON (CHESHIRE).—Housing scheme (40), for the U.D.C.; surveyor.

BOLTON.—Housing scheme (22 acres), Lever Edge Lane; borough engineer. Workshop and stores, Craddock Lane; McCreath, Taylor & Co. Extensions, Hill Mill, Temple Road; Henry Crossley.

BRISTOL.—Additional 58 houses for the T.C.; city engineer (returnable deposit of £1). School, St Anne's Park, for the City E.C.; A. R. Gough, architect, 24, Bridge Street (returnable deposit of £2 2s.).

BROUGHTON.—School (£14,300), for Northants E.C.; director of education, Northampton.

CAERPHILLY.—Aditional 80 houses for the U.D.C.; surveyor.

CAMBORNE.—Block of shops, for Fox & Sons, auctioneers and estate agents, Bournemouth.

CAPE TOWN.—Housing scheme at Maitland (£100,000); Citizens' Housing League Utility Company.

CHELMSFORD.—Shop property, Springfield Road and Victoria Road; S. H. Head, architect.

CHORLEY.—Estate development, Blackburn Road; J. B. Walmsley.

COLNE.—New school; borough surveyor.

CORNWALL.—Farm institute with hostel, Seale-Hayne Agricultural College, for the Governors; secretary.

COSELEY.—Schools, with electrical work, for the E.C.; Scott and Clark, architects.

CREWE.—Three schools (£107,866), for the borough E.C.; clerk.

DEVIZES.—Housing scheme (40), Jump Farm site, for the T.C.; A. W. Jakeway, borough surveyor (returnable deposit of £2 2s.).

DIDCOT.—School (300 places), for Berks. E.C.; W. C. F. Anderson, secretary, Reading (returnable deposit of £2 2s.).

DROXFORD.—Primitive Methodist church, Shirral Heath; trustees.

EDINBURGH.—Alterations at the Royal Infirmary, Lauriston Place; governors.

EXETER.—Two schools at Burnt Lane and Ladysmith Road, for the E.C. (£80,000); J. Bennett, city architect.

GLOUCESTER.—Extensions at the Gloucestershire Royal Infirmary; the governors.

GUILDFORD.—Extensions for 300 scholars, St. Nicholas School, Ludlow Road; the managers.

HARROGATE.—School houses to accommodate 250 boys in connection with the fusion of Ashville College and New College (£60,000 to £70,000): also swimming bath; J. T. Lancaster, head master, Ashville College.

HAYDOCK.—Public library, for War Memorial Committee; Stephen Wilkinson, architect, 16, Ribblesdale Place, Preston (deposit £2).

HIGH WYCOMBE.—Housing scheme (150 to 180), for the R.D.C.; surveyor. Housing scheme (178), Bowerdean, for the T.C.; borough surveyor. Factory extensions, for Furniture Industries, Ltd.

HULL.—Houses (110), Derrington estate; C. Smith. Rebuilding Station Hotel, Paragon Station; Hull Brewery Co., Ltd.

KINGSLEY.—Elementary school (£21,500); Cheshire E.C.

LARGS.—R.C. church; Rev. Father Doherty, parish priest, St. Mary's R.C. Church.

LEEDS.—Houses (72), Dewsbury Road estate; W. J. & R. Turnbull. Conversion of three police stations to branch libraries; Special Corporation Committee. Buildings, Merrion Street and New Briggate; Phonophones, Ltd. Lodging house; Medical Officer of Health.

LONDON (CAMBERWELL, S.E.).—Shops, 39-57, Camberwell New Road; F. A. Powell, architect.

(WIMBLEDON, S.W.).—Engineers' workshop, Hugh Stephenson's Works, Riverside Road; H. C. Robinson. Six shops, Durnsford Road; G. W. Beattie, Ltd.

MORECAMBE.—Houses (33), Fairfield estate; F. Obank.

NANTWICH.—Electric lighting plant, Baddeley waterworks, for the U.D.C.; clerk.

NEWBURY.—Houses (100), various sites; town clerk.

NEWSOME (YORKS.).—Housing scheme (115), for the U.D.C.; surveyor.

OLD HILL.—Development of High Haden estate with 126 houses, for W. Willetts, C.C.

OXFORD.—Housing scheme, Cuttleslow estate; city engineer. Employment exchange, Worcester Street; H.M. Office of Works.

PONTSTICILL.—Offices; Taf Fechan Water Board engineer.

RIPON.—Extensions, Diocesan Training College; the governors.

ROTHERHAM.—Houses (70), South Street: offices, shops, showrooms, and workshops (£22,000), for the T.C.; borough engineer.

SALFORD.—Re-erection of factory, School Street, Broughton, for Messrs. Freize.

SLOUGH.—Block of factories; Slough Estate, Ltd.

SOUTHAMPTON.—Warehouse, Town Quay (£11,000), for the Harbour Board; clerk.

SOUTHPORT.—Re-erection of Opera House, electrically equipped (£100,000); W. T. Moffatt, manager.

STANFORD-LE-HOPE.—School (350 places), for Essex E.C.; W. O. Lester Smith, director of education, Chelmsford.

STIRLING.—Housing scheme (52 to 64), for the T.C.; burgh surveyor. Re-erection of joinery works, Forth Street, for William M'Pherson & Son (£10,000).

STRATFORD ST. MARY (COLCHESTER).—Re-erection of Valley House (mansion), residence of Major-General L. R. Kenyon.

TAUNTON.—County offices, Crescent Field site (£80,000), for the Somerset C.C. Special Committee.

TWICKENHAM.—School (1,120 places), Jubilee Farm estate, for Middlesex E.C.; director of education, Eccleston Square, S.W.

WAKEFIELD.—Houses (150), Eastmoor estate; city architect. Houses (50), Lupset estate; Corporation architect. Alterations, Carlton cinema and Empire cinema; William Ilingworth, architect, Bradford.

WESTON FAVELL.—School (£27,000), for Northants E.C.; director of education, Northampton.

WHITBY.—Senior school (£12,060), for North Riding E.C.; J. C. Wrigley, secretary, Northallerton.

WHITEHAVEN.—School for the Borough E.C.; borough engineer (returnable deposit of £2 2s.).

YEADON.—Aerodrome; Leeds and Bradford Corporations.

YORK.—Estate development, Acomb; J. S. Barlow. Public Hall; Corporation Estates Committee.